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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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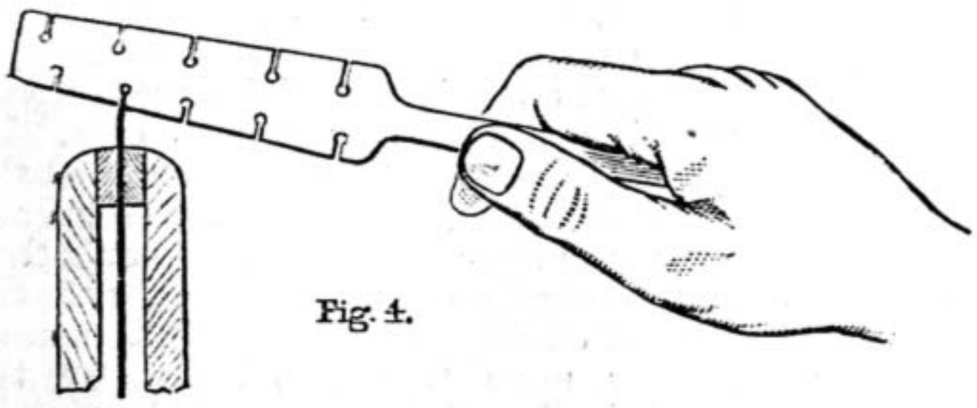

Fig. 4.

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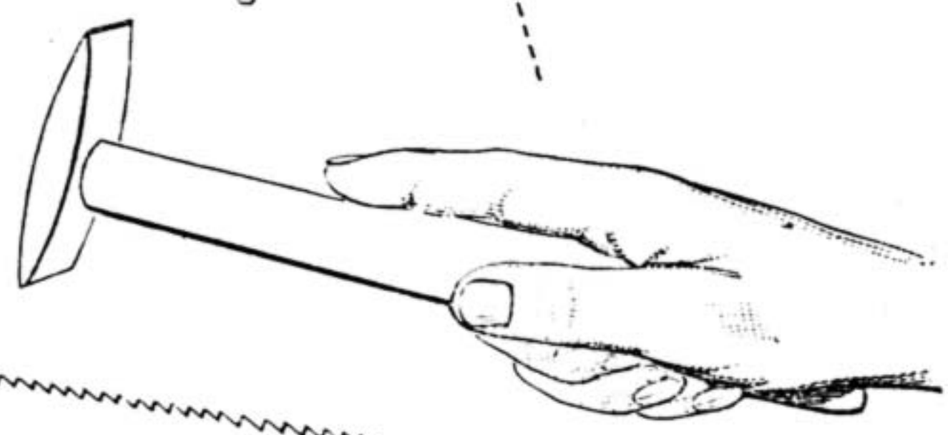

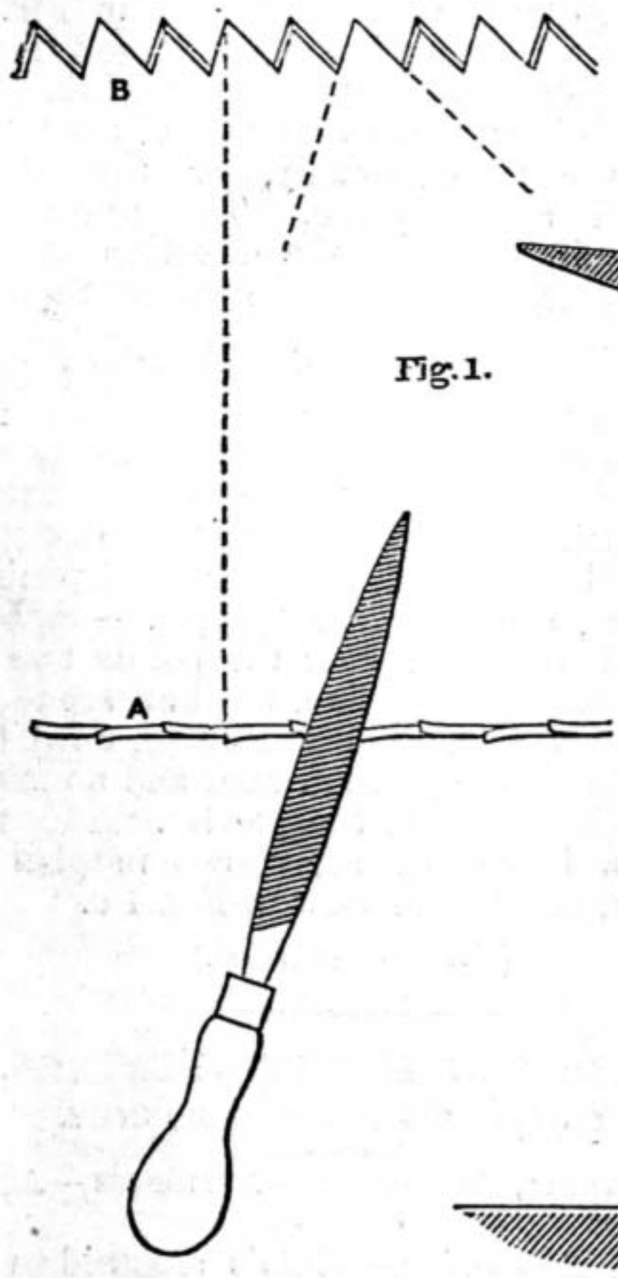

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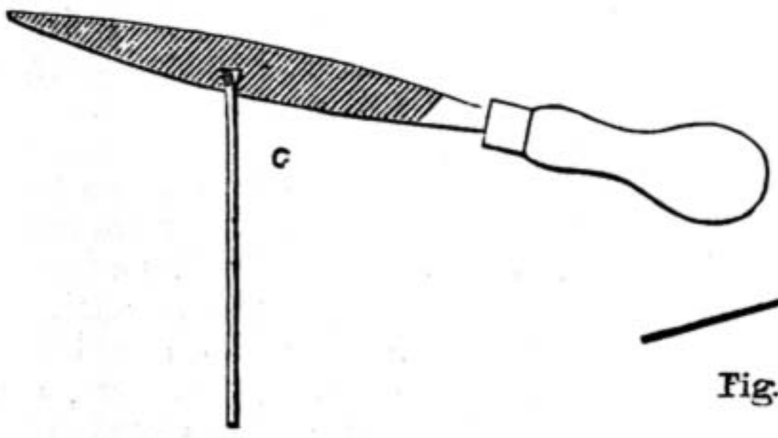

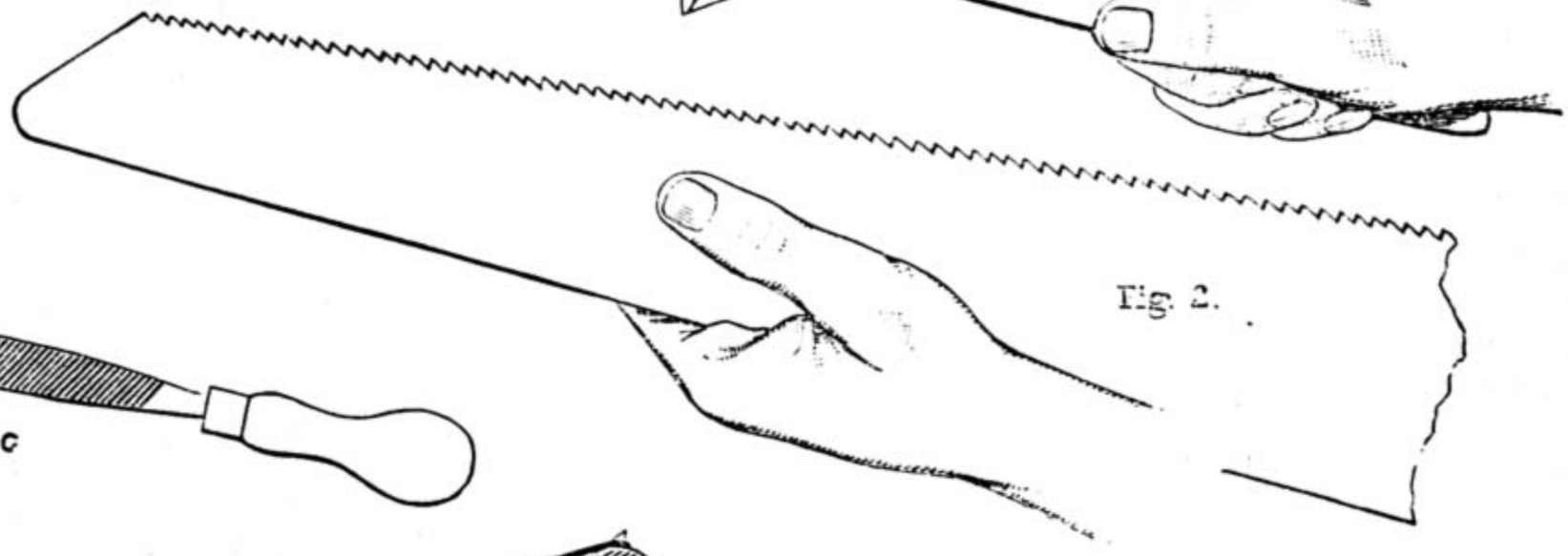

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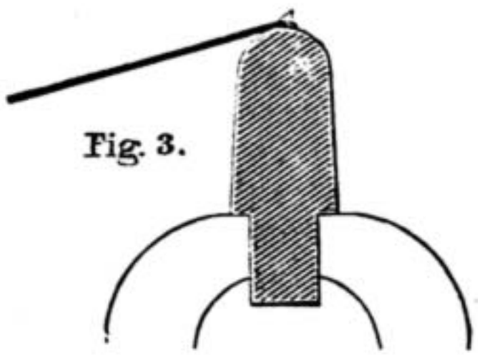

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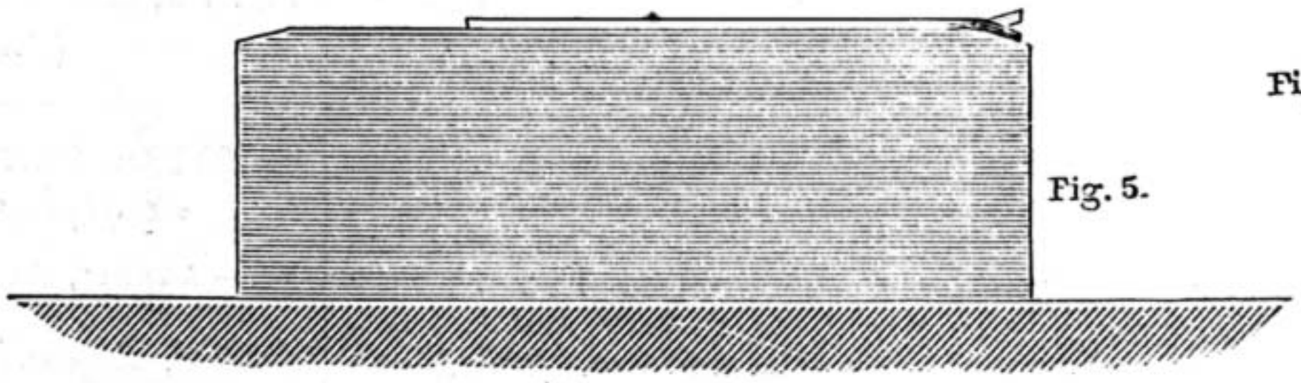

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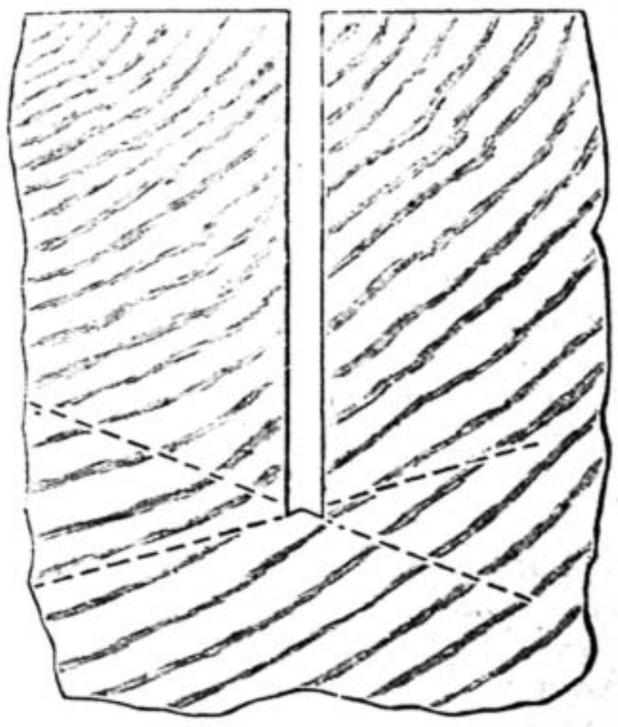

Fig. 7.

Fig. 1.—Hand-saw Teeth. Fig. 2.—Method of Setting on a Block. Fig. 3.—Section of Setting Block. Fig. 4.—Method of Using Plyer Set. Fig. 5.—Method of Setting by Chamfered Edge. Fig. 6.—Teeth with much "Rake," used for Cutting Soft Woods. Fig. 7.—Saw Kerf, Enlarged.

THE SAW: HOW TO USE IT.

BY J. H.

I.—VARIETIES OF SAW—TYPICAL HAND SAW—TEETH—GAUGE OF BLADE—SAW PLATE—STRESSING OF SAW—FORMATION OF TEETH—SETTING HAND SAW—PLYER SET—SETTING ON BLOCK—SHAPE OF HAND-SAW TEETH—TOPPING TEETH—ANGLE FOR FILE IN SHARPENING HAND SAW.

EVERYBODY uses, or tries to use, this most indispensable tool. But how different is its method of operation in the hands of a skilful or of an unskilful man; or when it is in good trim, or is out of order! So much is involved in the sweet working of saws, the minutest matters have so intimate an influence on their manner of operation, that some remarks on this subject may prove of interest and service to most of my readers.

First, as to the saw itself:—Confining our remarks to those used for wood working, there is first that general class, in its various modifications, of which the hand saw is the type, then the cross-cutting and circular, the back saws, the band and fret saws, and the various kinds used for cutting sweeped work; a whole host; all of which are used to a greater or less extent by amateurs and professional wood workers. Let us look at these *seriatim*.

Taking the hand saw type, we find this includes the hand saw proper, the ripping, half-ripping, and panel saws; all of similar outline, but differing in dimensions, and in form and size of teeth. There is no broad line of distinction between these tools, but they merge one into the other. Yet at the extreme ends it would be impossible to substitute the ripping and panel saws one for the other. The hand saw, however, which is a kind of compromise between extremes, is used indiscriminately for all purposes. What, then, are the characteristics of the typical hand saw?

Its length is from 24 in. to 28 in., being measured on the blade, which corresponds with the maximum range of thrust of which the arm is capable. Its blade is as thin as possible consistently with that amount of rigidity necessary to prevent buckling or doubling of the saw under thrust. The blade tapers in length, a form which is also best calculated to withstand thrusting stress without unduly increasing the mass of metal. The handle completely encloses the hand, so that no muscular effort is required to keep the hand from slipping away from its proper grasp. The teeth are bent to right and left alternately, while their outline

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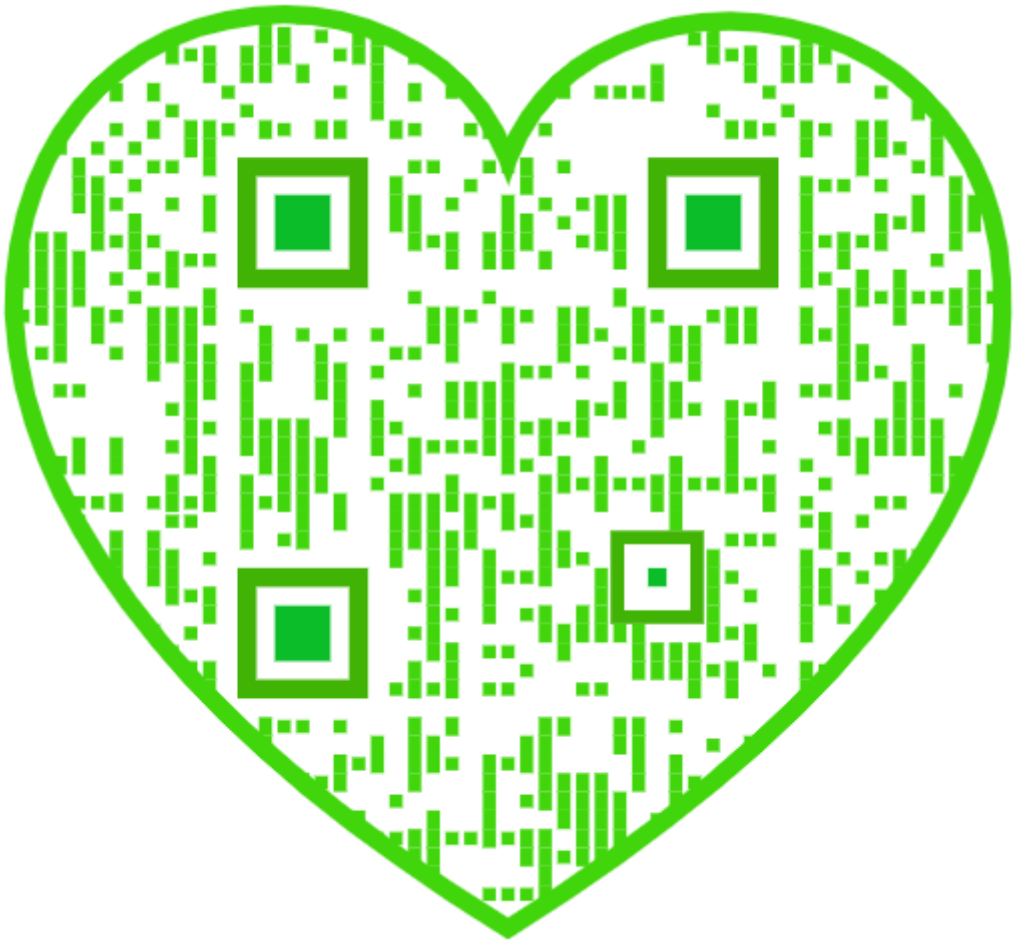

is triangular—the cutting angle being very obtuse, and apparently ill-fitted for dividing fibres. Lastly, the teeth are so sharpened that their outer points first enter the wood, and the fibre is divided by a gradually incisive kind of action. Now there is not one of these points that can be neglected with impunity, for they all conduce to the proper operation of the hand saw.

The thickness or "gauge" of the blade is an important matter, because increase in thickness means additional power required to operate it, and also more material wasted in dust. As a rule, select the saw that has the thinnest blade, which will generally be found the most flexible. The Eastern nations carry out this principle to a greater extent than ourselves, by using saws so thin that they cannot be thrust, but are instead drawn towards the workman, and cut only when being thus drawn towards the operator—the rake of the teeth being placed in the reverse direction to that of ours. I do not think this is good in principle, because much greater power can be exercised in a thrusting stroke than in a pulling one, and I have not the slightest doubt that an English carpenter with his hand saw would beat by a great deal a Japanese or Indian sawyer at a trial of results.

Our best English hand saws are not only thin in the blade, but they are tapered from the cutting edge towards the back. To a slight extent, therefore, they clear themselves in the cut, and there is, in consequence, less loss by friction than in the saws of parallel thickness.

One important point in a saw plate is that it must neither show winding, nor buckle. Either defect will cause the saw to "run" in its cut, so that it will be impossible to work to a line, or only possible by exercising constant coercion on the saw in one particular direction. These evils are seldom present in new saws, but they become developed by careless usage, as forcing the saw violently through wet and harsh timber, letting it slip out of the cut, so that the point drops upon the timber while the pressure doubles or bends or otherwise stresses the saw. A saw blade once out of truth is very difficult to put right again; and if an amateur attempts by hammering to restore it to its original condition he generally contrives to indent it with hammer-marks without removing the evil. The best plan always is to take it to a saw-sharpener, who by a skilful direction of blows will generally level the plate, the process being akin to that used in operating sheet metals, the material being slightly thinned out in certain sections relatively to others. But a saw may be so badly buckled that no skill will suffice to make it what it was before buckling. Hence the reason why violent stressing of saws should be avoided.

Since this stressing is most apt to occur in wet and harsh timber in which the saw is moved with difficulty, and in timber for which the form of the saw teeth is not adapted, obviously the principal means by which a saw can be preserved in good working order is by paying particular attention to the manner of the formation of the teeth. This is really the fundamental point, attention to, or neglect of, which makes the principal difference in good or bad results.

The formation of the teeth depends on two matters—first, "set," or the amount of bending given to alternate teeth to right and left of the median line; and the method of sharpening, by which the rake and angles are imparted.

Although the blades of the best saws are thinned slightly towards the back, this by no means obviates the necessity for setting. All wood-working saws without exception have their teeth bent from side to side alternately, in order that the width of the "kerf," or groove made by the teeth, shall be slightly greater than the thickness of the plate, so that the broad surfaces of the latter shall move through the wood with the least amount of friction possible. This set is extremely variable in amount, and is necessarily so varied by reason of the wide difference in the nature of the materials which have to be divided, the extremes being, say, thick, wet, and soft wood, cut across the direction of the grain-fibres; and thin, dry, and hard wood, cut in the direction of the grain-fibres. The hand-saw tooth is not formed for so great extremes as these, but it will nevertheless embrace a very wide range of work.

Fig. 1 A represents about the average quantity of set given to a common hand saw suited for general work; that is, work within the ordinary limits of that done on the bench. This is imparted either on a setting block or by means of some form of saw-set, of which there are many. Fig. 2 shows how a saw is set on a block. The latter is a piece of iron whose section is seen in Fig. 3, and which is clamped in a vice. Upon the rounding edge the saw is held with the left hand at the particular angle required for any definite quantity of set, and the alternate teeth are struck sharply with the narrow-paned setting hammer, held in the right hand. When the alternate teeth which lean in one direction have been so treated, then the saw is reversed end for end, and the opposite alternate teeth struck.

Another common method of setting adopted is that effected by means of the "plyer" set. Here the teeth, instead of being hammered, are gradually bent over, the saw being either held in the left hand, or in the vice the while. (Fig. 4.) Of the two, I much prefer the hammer and block, because the set can be rendered more precise and uniform, and I think the risks of fracturing brittle teeth are diminished. An abrupt setting over of the teeth is also more efficient than a gradual bending from their roots; at least, that is my own opinion. The only objection to the setting block is that in unpractised hands the angle of the saw relatively thereto (see Fig. 3) may possibly be permitted to vary, and the setting, therefore, not be uniform. This, however, is a question of skill, which comes by use. But a good substitute is a block of iron, or even of hard, close-grained wood, having one edge chamfered to the quantity of set required. The saw being laid (Fig. 5) upon this, the set is imparted with the hammer, and the angle of the teeth cannot be other than that precise amount corresponding with the bevel of the edge. If hard wood is used for the block, its grain must run vertically, so that the ends of the fibres shall be opposed to the indenting force of the hammer.

In whatever manner this set is imparted, and whether it be much or little, absolute *uniformity* is of the first importance. A saw with a comparatively small amount of set, if regularly given, will operate better in wet stuff than one whose amount is greater, but given irregularly.

The shape of the hand-saw teeth is shown in Fig. 1 B. It will be noted that the rake of the teeth (*i.e.*, the amount of their leaning forward) is such that there can be no true cutting action. For the teeth to cut truly they would require to be formed with a good deal of rake, as in Fig. 6. But the quantity of rake thus represented would unfit a hand saw for general work. Actually, then, the hand-saw teeth (Fig. 1) are in principle an assemblage of scrapes, and as such they have little penetration. Wedge-like teeth having much penetration, like Fig. 6, would cause much hitching and jarring of the hand to occur, particularly in operating hard wood and in cross cutting. But there is a certain incisive action in Fig. 1 very much akin to, if not identical with, that of the wedge or chisel form, and it is due to the method of sharpening adopted. Looking at Fig. 1, A, B, C, it is seen that the teeth facets are bevelled in both directions, so that they first enter, and divide the material by their extreme outer corners only. To note what would result if such were not the case, imagine the teeth to be sharpened perfectly square across—the saw would then work extremely dead and heavy, and the labour of cutting would be vastly increased, probably more than doubled. But the teeth being bevelled, the action is such that the severance of the fibres takes place in a diagonal direction. This is seen in Fig. 7, showing a saw kerf much enlarged, from which it is evident that the action of the tool has much in common with that of the wood chisel worked diagonally, or the skew-mouthed rebate plane. The fibres are divided in series in the direction of the dotted line, and excessive stress thereby avoided.

Lastly, in order to the most perfect action, all these tooth points must be in line; if they are not, those which are below the rest will be inoperative. Hence, in sharpening, as in setting, perfect uniformity is essential to the best results. Before sharpening, therefore, the teeth are "topped"—that is, the file is run down over the points two or three times in succession, until all are level, and then the sharpening follows, until the blunted tops are just removed and no more. The angles at which the file is held for the common hand saw are shown in plan in Fig. 1 A, and in end view in Fig. 1 C.

(To be continued.)

NOTES FOR ELECTRO-PLATERS.

BY GEORGE EDWINSON BONNEY.

VI.—ANNEAL, ANNEALING—ANTIDOTES—AQUA-FORTIS.

Anneal, Annealing.—Metals are said to be annealed when they have been heated and cooled in such a manner as to render them softer and more pliable afterwards. The temperature to which a metal must be heated and the method of cooling afterwards differ in each case, and a knowledge of this difference forms a part of the art of annealing. Iron (and all its compounds or alloys) is made hard by heating to a dull red, and cooling it rapidly, as by plunging it in cold water; but when allowed to cool slowly in hot ashes, or enclosed in a metal tube previously heated and surrounded with a bad conductor of heat, it then becomes soft. The hardest steel can thus be made soft enough to be cut with steel tools.

Gold, copper, silver, and some kinds of brass may be annealed by being heated to a dull red, and allowed to cool gradually, or they may be plunged at once into cold water without any apparent effect on the annealed metal. The art of annealing is practised by those workers in metals who

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draw them into wires or beat them out into thin plates. To anneal gold, silver, and copper anode plates, or strips, heat them to a dull red and cool in water. Tarnished silver plates may be cleaned by cooling them in a dilute solution of potassium cyanide, such as the cyanide dip used in nickel plating. Copper and brass plates may be cleaned by cooling them in a very dilute solution of one part sulphuric acid in forty parts of water. This should be warm to properly clean brass. Where naked wires and strips of copper are used as conductors of electricity, as between battery and bath, or in use as slinging wires, they become brittle with long use, and should, therefore, be carefully annealed occasionally to restore their softness and pliability. Pure copper may be annealed at a low heat. Fine copper wires passing from one conductor to another (as those leading from the poles of a powerful plating dynamo) will become heated by the current and annealed in passing.

It is sometimes necessary to anneal articles of jewellery in the workshop to colour them after being repaired. This should be done cautiously to avoid unsoldering any parts soldered with soft solder. Best silver-soldered goods will stand the annealing and colouring process all right. See notes on *Colouring*. It is probable that the process of annealing changes the positions of the small particles which go to make up a sheet, a bar, or a wire of a metal. What this change is cannot be demonstrated, but probably it is in the direction of an alteration from a crystalline to a fibrous form of structure. Some curious effects are observed in annealing alloys and metals coated with gold or silver. These suffer a permanent change in colour by the annealing process. German silver loses its whitish lustre, and becomes a dirty grey. The kind of brass known as gilding metal loses its gold yellow tint, and becomes coppery. Gilded copper articles lose the pure gold tint, and assume a dark coppery hue. Gilded silver articles assume a brassy yellow tint. Silver-plated copper, and alloys of this metal, are blackened by annealing. If the process of annealing is carried on too far—that is, the metal subjected to too much heat—the discoloration becomes permanent, and the gold or silver coating is said to be "sunk." If not carried too far, the colour can be restored by a judicious course of pickling. Rules, embodying a scale of safe temperature for annealing gilded and silver-plated articles, might be drawn up if we knew the exact thickness of the coatings and the composition of the metal beneath. But the safe line varies with the thickness of the coat of precious metal, and it needs a trained eye to determine by the change in colour when this line is reached. The changes of colour which take place on the surface of metals during the process of annealing are little understood. For instance, if we anneal a piece of copper coated with gold the gold coat disappears, and the surface seems to be composed of an alloy of gold and copper. Is what we see a real alloy of these two metals? If so, the alloy cannot have been obtained by fusion, for the annealing temperature has not been raised to the fusing point of either metal. Has the gold sunk into the surface of the copper? If so, the pores of the copper bar must have opened under the influence of heat and received into their mouths, so to speak, the fine particles of gold which covered them. This seems to be the only tenable explanation. In the alloyed surface the two metals are so intimately mixed in such a fine state of division, as to give it the appearance of a real alloy obtained by fusion, but the intruding grains of copper may be dissolved in an acid pickle, and leave the gold coat in its former pure condition. A similar result follows the annealing of any other plated metal.

Antidotes.—An antidote is a medicine that counteracts the influence of a poison—that is, opposes and neutralises its action. As electro-platers work with deadly poisons, they should be well acquainted with the deadly properties of those poisons and their antidotes. Under the heading of each poisonous substance mentioned in these notes, I have given cautions respecting its use, and directions respecting the selection and application of the proper antidote in case of accident. The general rule respecting the choice of an antidote is as follows:—Choose a substance that will combine at once with the poison and form a compound having no action on animal tissues. Antidotes should be promptly applied, and therefore should be kept at hand in an easily accessible position. *The antidotes to acids* are such alkalies as magnesia, soda, potash, or even chalk, mixed with lukewarm water and swallowed at once. Afterwards take a little milk, or broth, or such vegetable oil as olive oil, or oil of sweet almonds. It will also be safe to take a dose of castor oil in the course of a few hours. *The antidotes to alkalies* are such vegetable acids as vinegar, acetic acid, lime juice, lemon juice, or orange juice diluted with water and taken at once. If neither of these are at hand, ten drops of sulphuric, nitric, or muriatic acid in a wineglass of water may be used instead. After the pain has abated, take a tablespoonful of olive oil. Later on, cleanse the stomach and bowels with a dose of castor oil. *The only safe antidote to poisoning by metallic salts* is an abundance of warm water to be drunk at once so as to cause copious vomiting. If this does not succeed speedily, other means must be employed to cause vomiting, or the stomach-pump must be used. Most metallic salts may be converted into insoluble and inert sulphides by taking a strong dose of milk of sulphur, or flowers of sulphur, but it is best to get them out of the stomach as soon as possible to avoid bad after consequences. Afterwards the stomach may be relieved and comforted by a good egg beat up in a glass of milk.

The antidote to poisoning by cyanide in all its forms is a solution of iron. The common *green* vitriol or protosulphate of iron dissolved in water may be used. But as some time may be lost in preparing this remedy, it will be well to keep always handy some *steel drops*, obtainable at any chemist's shop. Give half a teaspoonful in a wineglassful of water *at once*. Then dash cold water over the head and down the spine of the sufferer. Stimulate the heart's action by giving brandy, either neat or mixed with warm water. As the action of this poison is fearfully quick, prompt action in applying the antidote will be needed to avert fatal consequences. Sal-volatile may be used where brandy is hard to get or unattainable. Liquor ammonia, six drops in a wineglassful of water, will also give relief. *The antidote to acid fumes* is the fumes of ammonia, either from ammonia carbonate or diluted liquor ammonia sprinkled on the floor. *The antidote to ammonia* fumes is the fumes of chloride of lime, or some other fuming chloride; as chlorine combines with ammonia to form sal-ammoniac, and this is simply innocuous. See also notes on *Cyanide of Potassium*, *Prussic Acid*, *Poisons*, *Poisoning*, etc. etc.

Aquafortis.—A name given to commercial nitric acid. It is evidently a word compounded from two Latin words meaning respectively "water" and "strong" to denote this liquid as being a strong water. For further information see note on *Nitric Acid.*

(To be continued.)

SIGN WRITING AND LETTERING.

BY HENRY L. BENWELL.

IV.—Use of Guide Lines—The Alphabet in Freehand — Skeleton Letters—Necessity for Practice.

I HAVE so far merely considered freehand drawing more or less from a general point of view, but must now direct the pupil's attention as to the best course to pursue in becoming proficient in truthfully and accurately forming and drawing the letters of the alphabet without any mechanical aid whatsoever.

I will afterwards give some directions for the making of various "guide" lines, which are sometimes used as an aid by the sign writer in forming accurately and quickly some of the more difficult letters, such as C, G, S, and &. But I must impress upon the learner how absolutely desirable it is to, first of all, learn to be able to draw all the letters in a bold and workmanlike manner by freehand alone, and using his eye as his guide pure and simple. I may also add that although "guide" lines are all very well in their way, the young student, if he wishes to master this art and become a capable workman, must eschew them altogether in the preliminary stages of his practice. And, be it said, that our best "writers" never make use of these aids to correct drawing, but trust to the eye and hand alone, and that it is by this method that all the best displayed and boldest work is turned out, and which, of course, invariably bears the imprint of the master hand and an artistic eye and mind.

I will admit that occasionally it is next to impossible to construct one's letters properly and truthfully unless they are drawn or formed by mechanical means. Take, for instance, the case of the workman being confined in a very awkward and cramped position, or being up aloft on a frail platform and at a great height, in fact, sufficiently high to unsteady the nerves, and consequently the hand. Again, supposing some very large letters have to be painted on the front or side of a house, and also at a great height; in this case it is almost impossible for the workman to have sufficient room to stand far enough back to occasionally survey his work, and gauge its appearance or detect any imperfections or malformation of letters. Therefore, in such circumstances as these the use of any mechanical aid or guiding lines is perfectly legitimate.

A good many of our most dexterous and expert sign writers seldom chalk their letters out at all, but proceed offhand to write them in with the pencil and colour. And even when they do previously mark their letters out, it is merely in a rough and sketchy manner, and more with the object of properly spacing their letters and filling in the allotted space on the board evenly than anything else; and they very seldom follow their chalk lines in painting the letters, but, on the other hand, let the pencil follow its own inclination.

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In commencing to practise drawing the alphabet in freehand, it is better for the learner to first of all draw simple outline letters. For this purpose, then, I here give a sheet of "skeleton" letters (Fig. 27), together with numerals.

It is, perhaps, just as well to draw these on paper with the lead pencil for a while; but, taking it for granted that the learner has been practising hard on the two previous lessons, recourse should soon be had to the blackboard, and once here, the work should proceed with both the chalk and the camel-hair pencil filled with colour.

Now, it takes but very few words to describe this method of procedure for a first attempt upon the alphabet, but as it is the whole groundwork and foundation of letter-forming and letter-painting, it is very important that the student should be very pointedly told, also, that he must completely master this lesson, or, speaking still plainer, be able to form each letter at least in a decent way before he can hope to become a creditable craftsman, and, more important still, earn money by his craft. Therefore, at this stage of our lessons more than any other, the watchword should—in fact, *must*—be *practice*, PRACTICE, PRACTICE. It is far from my wish, of course, to dishearten the pupil; on the contrary, every inducement will be thrown out and encouragement given to the youth about starting in life to adopt and follow this educational, remunerative, and elevating art trade of sign writing, which to some, the writer included, is fascinating to a degree. It is, in fact, my enthusiasm in the subject which induces me to so strongly urge my readers to "stick to it" in this fourth lesson. Do not become disheartened at repeated failures, and "throw it up" altogether. That is not English pluck and doggedness, and failures there must and will be at the commencement, but which repeated practice will slowly but surely overcome. Some letters will be very difficult to form correctly, especially the S and the "short and" —&; but each succeeding effort on the part of the pupil will show some improvement, however slight and imperceptible it might be to the untrained eye. As the work improves in quality, so will the workman be the better able to see its imperfections, although for the life of him he cannot tell the exact points, perhaps, where the fault lies. But after a bit he will perceive and detect these also, and eventually be able to correct bad lines, and, in their place, render with precise and masterly touch those he has so long desired to obtain. Once, therefore, he has surmounted the somewhat difficult task of forming in shapely and pleasing manner the whole of the letters which our alphabet contains, his greatest obstacle on the road to progress is passed, and the rest, it can confidently be said, will come naturally and easy to him, with one possible exception—that of colours and colouring.

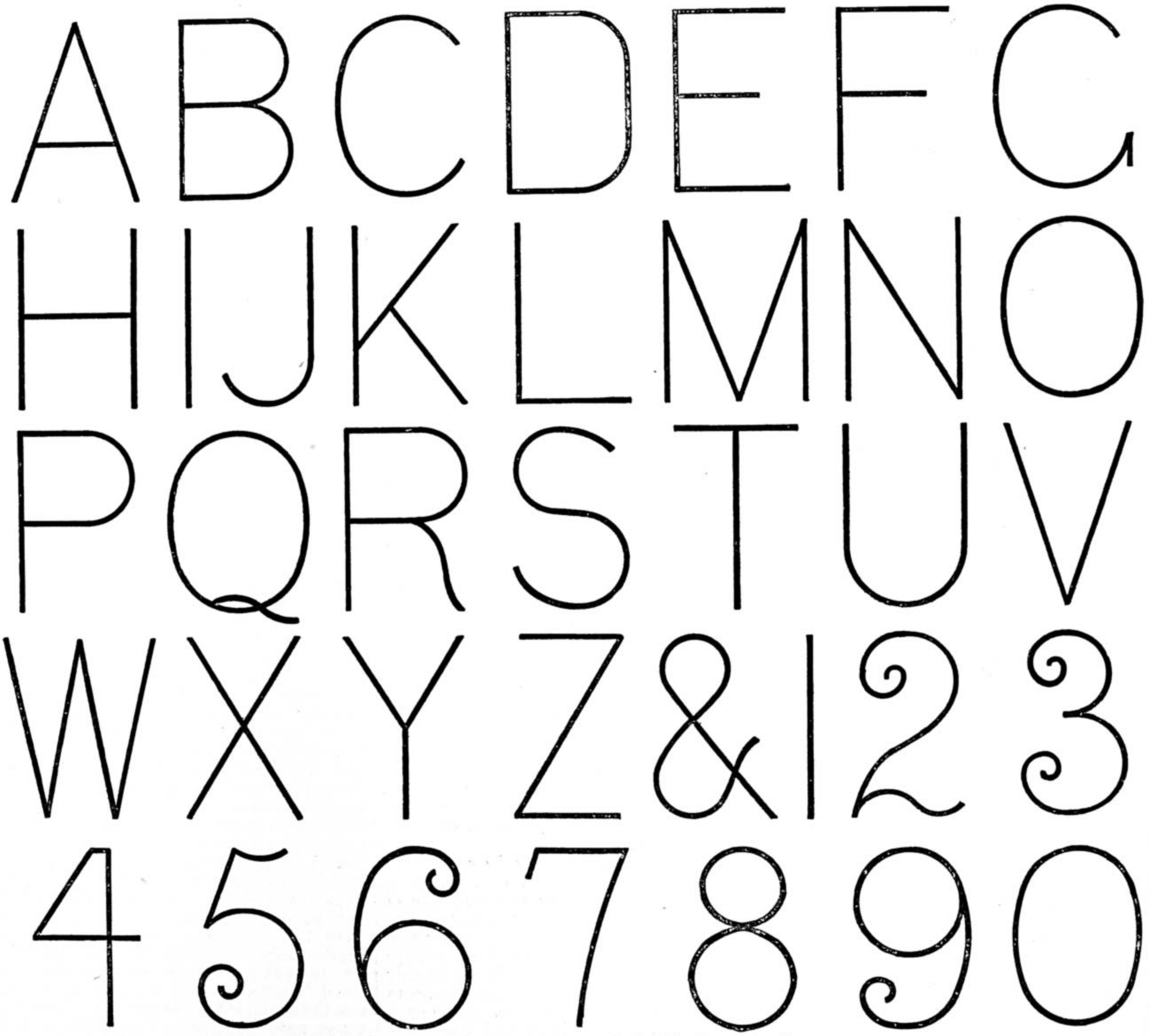

Fig. 27.—The Alphabet and Numerals for Freehand Practice.

Leaving the student at this point to follow the precepts I have just laid down for his guidance and success, I will seek to do no more at present than remind him that the examples given in the accompanying skeleton alphabet are to be drawn by him on a larger scale, as the other freehand exercises that have been already given in these papers.

(To be continued.)

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HERALDIC CHASING.

BEING HINTS FOR THE ORNAMENTATION OF HARNESS, ETC.

BY OPIFEX.

HERALDIC chasing is the art by which crests, coats of arms, monograms, and various kinds of ornaments, etc., are made in gold, silver, brass, or indeed in any of the ductile metals or alloys.

The subject of this paper is not Heraldry, which is a most interesting subject in itself, and one which well repays the intelligent student, being so intimately connected with the history of our country, and having so many legends of romance and chivalry embalmed within it; but we are only indirectly concerned with it now.

Heraldic chasing presupposes some knowledge of Heraldry, or, at least, the possession of a design prepared by one who possesses it; and my object is to help my brother amateurs to produce articles in this *line*, about the manufacture of which ninety-nine per cent. of us are entirely ignorant.

We will assume, then, that some reader is anxious to have a set of crests for his harness, that he is possessed of sufficient energy to undertake the work himself, and that he is furnished with an accurate drawing of what he desires to produce.

Heraldic chasing is the near relative of repoussé work, in fact, it is its direct offspring, so that those readers who are proficient in that art will have little to learn, and will find that their knowledge has merely to be applied in a groove slightly differing from pure repoussé work.

The tools employed are of the same kind, but generally of a finer make, our subjects being, as a rule, more elaborate in detail and more highly finished than works in repoussé.

Our first example given at Fig. 1 represents a falcon's wings with hooded head, and is a simple crest, easily executed, and the following directions apply to all subjects of a like nature.

There are two methods by which this work may be executed: one very simple and perhaps more suitable for beginners, but *not* the correct or professional method, and therefore not so satisfactory in its results as the other; however, I give it in hope it may induce some one to attempt the work who might shrink from the other and more complicated process.

Whichever method we follow, there are certain special tools and appliances required to make a beginning, which I shall enumerate at the outset.

The necessary tools are:—First a medium-sized chaser's hammer; any small hammer will do in an indifferent sort of way, but the reader is strongly advised to obtain a professional chaser's hammer, at a cost of about half a crown.

Next two tracers—Nos. 1 and 2, as used in repoussé work, ¼ in. and ⅛ in. respectively. (See Fig. 2, A.) These tools should be flat on one side and rounded on the other, the edges being formed by grinding down the *round* side. The advantage of these over other shaped tracers is that curves and straight lines may be traced with them with equal ease, and also a greater degree of *relief* can be obtained by their use. We shall also need two straight tracers (Nos. 3 and 4), $\frac{3}{16}$ in. and ⅛ in. respectively, ground on both sides; these tools should be *rather* sharp, but smooth at the edge; we also need one ⅛ in. made quite sharp. These will be sufficient for the present, and I shall describe any others as occasion requires.

The following appliances, etc., are also essential:—Some flour emery and crocus powder, soft rags or cotton waste, sweet oil, steel wire scratch-brush and sheet of carbon transfer paper, an H.B. pencil, several small files of various shapes, a small soldering iron, some common solder and "killed spirit," a small block of hard wood, say about 6 or 8 in. in diameter, and the same length—a piece of this size cut from a beech bough will suit admirably if the faces are cut parallel and made tolerably smooth—some ⅝-in. "cut tacks," a fine bradawl, and last, but most important of all, we require the material to work upon; this must be thin sheet metal, brass, or silver (or gold!), but "fiat experimentum in corpore vili," which, being interpreted freely, means, "on the present occasion let us experiment in common brass." It is cheap and *not* nasty, and for our present purpose (harness crests) is in much better taste than silver, but this, of course, must depend upon the other mountings; as to thickness, No. 25 gauge brass is what we need.

Fig. 1.—Crest: Falcon's Wings with Hooded Head.

Fig. 4.—Section of Crest taken across Centre.

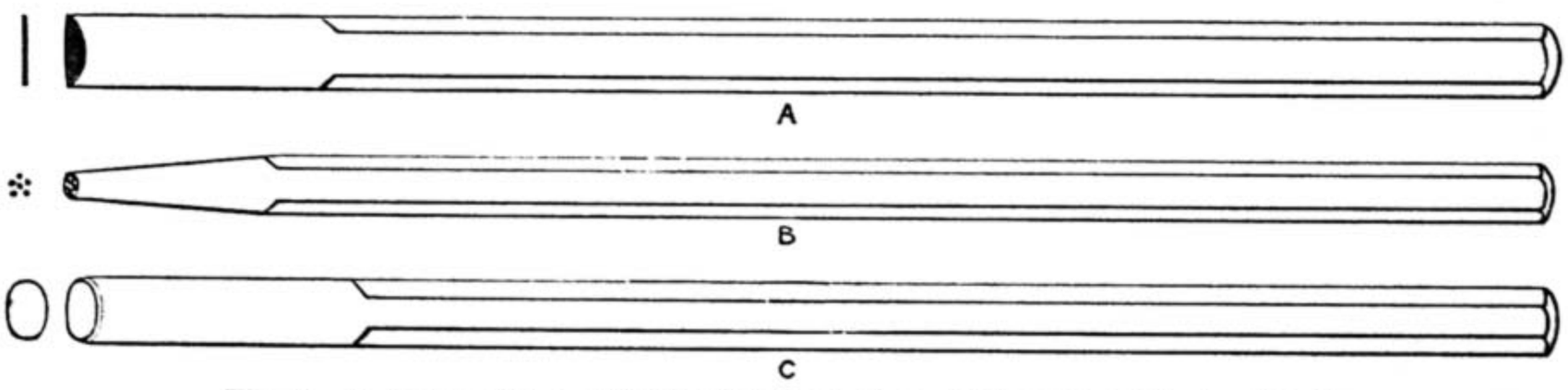

Fig. 2.—A, Tracer No. 1; B, Punch No. 5; C, Relief Punch or Beater No. 7.

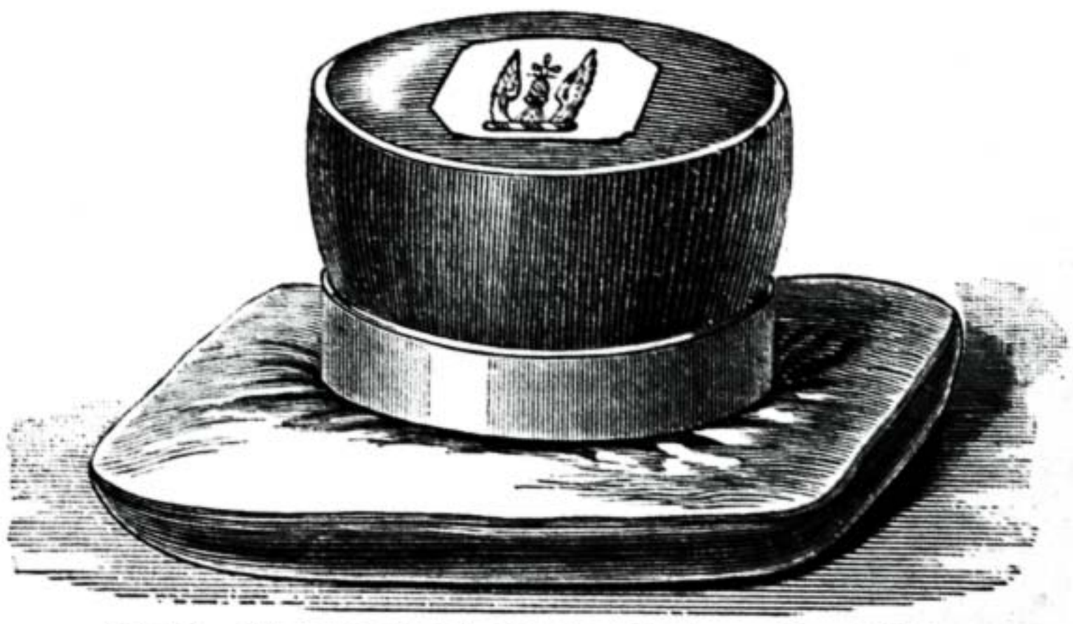

Fig. 3.—Chaser's Bowl, filled with Cement or Pitch.

And now as to method No. 1. Cut a piece of brass about 3 in. by 5 in. or sufficient for two crests, and having made the metal quite flat proceed to cleanse and polish it on both sides, using, first emery and then crocus; or you may polish in any of the other approved methods, as in repoussé work, but the above will suit the subject in hand. Next, wash the brass well in hot water with soda and soap, to remove all grease, and rinse clean and dry. Now scratch-brush one side all over (in the absence of a scratch-brush emery cloth will serve) or scrape the surface with any sharp instrument. The object of this operation is to prepare the back of the work to receive the solder, which, as we shall see, is to be run into the reverse side of the crests.

Next lay the brass upon the block, scratched side down, and with the bradawl make a row of holes all round about an inch apart and a quarter of an inch from the edge; then tack the metal securely down.

We are now ready to transfer the heraldic device to the brass; this is effected by placing a piece of carbon paper upon it. Next place the design upon the carbon paper, and with a sharp pencil go over all the markings carefully; repeat the operation for a second copy; and we should now have two facsimile drawings in black upon the metal. Sprinkle a little French chalk upon the brass, rub gently over the drawings, and all danger of "smudging" will be obviated.

In the case of the present example the transfer may be made direct, but in dealing with crests, monograms, etc., which would be reversed by transferring (such as a lion rampant, etc.), it will, of course, be necessary to prepare a negative design.

The simplest way of doing this is to place a piece of carbon paper upon a hard, smooth surface—a piece of plate glass is best—lay the design upon it, and then go over the drawing with a hard pencil (as above), when a facsimile will appear on the *wrong side* of the design, which may then be transferred to the metal.

And now for the actual work. Taking tool No. 1 or No. 2 in the left hand and hammer in the right, proceed to indent lightly the outside of the design (*i.e.*, leaving out such markings as feathers, crossbars on the "hood," etc., in the example in hand), keeping the flat side of the tool next the design, using No. 1 for all the straighter lines and No. 2 for the smaller curves. When the whole of the outline is thus indented, go over it again, more decidedly this time, repeating the operation until all the lines are indented evenly and as deeply as possible; but this result should be arrived at by frequent rather than violent application of the tool.

Having treated both crests in this way, punch down the brass immediately surrounding the design with No. 5 (see B, Fig. 2), as this will help to raise the figure in higher relief, and also render the after process of cutting out easier.

Employing No. 6, proceed next to cut

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through the whole outline as already traced. This process requires care, not striking too heavily, but with just sufficient force to go through the brass.

Of course, it may be necessary to use sharp tools of different sizes and shapes, modifications of No. 6, in cutting out. This, however, must be left to the judgment of the worker, who should always endeavour to cut out the crest, etc., as clearly as possible as regards outline. The operation of cutting out may also be performed with a fine fret saw, as used by jewellers; but this also is a matter for the worker's decision.

So far, as regards No. 1 method; but, as before stated, this is not a satisfactory process, and for this reason—we have not been able to provide for the proper *shaping* of our subject. All has depended on the fact that the untouched brass within the outline has become bulged up by the process of tracing and the use of the matting tool, and we are dependent on the after chasing for form, which in some simple cases may answer well enough; but in order that our work can possess any real artistic merit, some other method must be resorted to by which we shall be enabled to *model* our subject, leaving nothing for the after chasing but details, such as the feather markings in the example before us.

In case my readers are not repoussé workers, it will be necessary here to give directions for carrying out this alternative and more correct process.

Instead of the uncompromising block, which takes no impressions, we must provide ourselves with a chaser's "bowl," *i.e.*, a round basin of cast iron. These are of different sizes and shapes, but such a bowl as that shown at Fig. 3 will suit us best. This is filled with the substance known as chasers' cement, or, more familiarly, "pitch," which is really a mixture of pitch, resin, tallow, and Paris plaster or sand. The pitch should be melted and poured into the bowl until it just overflows, and when almost cold the brass should be heated, *unscratched* or right side rubbed lightly with oil or tallow, and placed next the pitch, pressing gently, so that it shall sink sufficiently to make sure of it adhering to the pitch. The corners of the brass may be turned down with advantage, for further security. When the pitch is almost cold—*i.e.*, when applying the hand to the brass we can feel a suspicion of warmth—the design may be transferred as above, and we are then ready to repoussé, or punch down the metal, so that when it is turned we may have our crests, etc., correctly shaped, and so have a much better subject for chasing than could possibly be obtained by the other method explained above.

The tools required for this are, in the present example, only three in number—Nos. 7, 8, and 9 (see c, Fig. 2).

No. 7 is an oval-shaped relief punch or "beater."

No. 8 an oblong, $\frac{1}{8}$ in. long.

No. 9 a very small "edition" of No. 8.

Using No. 7, the broader portions of the design should be punched down, at first all over to an equal depth, and when by repeated applications the desired degree of relief is obtained, the details of form should be attended to, *e.g.*, the pinions in the present exercise.

It must also be borne in mind that crests should be beaten down to a depth considerably greater than that which would suffice to give correct form. At Fig. 4, I give a section of the crest taken across the centre of the design, which will serve to explain my meaning, by comparing the depth of relief necessary in this work with that which would be sufficient in ordinary repoussé work; the line, A B, representing the level of the metal for crests, and the dotted line, C D, indicating the relief as in repoussé. If this is not attended to, the crests will be much too thin, whilst if my directions are followed, they will stand out well upon the harness and be most effective.

Tool No. 8 will suit best to beat down the crest "wreath," and No. 9 the cord by which the hood is held; both these tools will also be brought into use for the sharper portions of the wing, feathers, etc.

When both crests are treated as above the brass should be removed from the pitch, well cleansed, and washed in hot water with soap and soda.

Next cut out with fret saw as above; or place the metal face upwards upon a block of lead, and cut out with No. 6, etc., in either case using great caution in order to preserve the correct outline of the design. And now we have reached the same point, whichever method we have employed, and the following directions are equally applicable to either.

The crests being cut out, are now placed face down and painted over on the back with "killed spirit" (spirits of salts, in which zinc is dissolved until it will dissolve no more), then with the hot soldering iron let the solder run in, until the crests are just full, care being necessary to avoid allowing the solder to overflow and stick to the right side of the articles; guard against this at first by coating with blacklead and beer, as in plumbing work.

We have now two solid crests, the edges of which are rough and jagged, and the next step is to file them out clear and sharp, using the small files of different shapes to suit the intricacies of the work.

We now arrive at the most important and interesting part of our work, namely, the chasing of the crests. To accomplish this the subject is placed upon the block—a larger one than that described above, say, about 10 in. in diameter and 6 in. deep—which should be placed upon a sand cushion upon a solid bench or table.

Having the original design placed so as to be easily seen, next proceed to indent all the lines exactly as they appear in it, using the tracers described above, and choosing those which suit the different lines, curves, etc., as occasion requires, taking great care to follow the drawing faithfully.

In this operation there is unlimited scope for artistic work, but the worker must depend almost altogether upon himself for success, as it is well-nigh impossible to give more than the most general directions as to chasing. But I may say that a safe rule will be to follow faithfully the markings in an accurately drawn pen-and-ink design, and the result will be found to be satisfactory.

The chasing being finished, the next step is to provide means of attaching the crests to the harness. This is accomplished by fixing short pieces of copper wire to the back in several places, so as to ensure that the crests shall be quite flat and secure. Take a piece of ordinary bell wire, and having made it straight by stretching, rub it well over with fine emery cloth until quite bright; next having a hot soldering iron at hand, dip the end of the wire in killed spirit, and applying it to the part of the crest where it is desired to fix it, hold it perpendicularly, and apply the point of the soldering iron to the solder; the result will be, that the solder melting, the wire will sink down to the brass, and holding it there for a few seconds until the solder sets, the wire will be found perfectly fixed. Now with wire nippers cut off at about three-quarters of an inch, and repeat the operation until a sufficient number of wires are fixed—in the present example five in each crest will be required, one at the point and base of each wing, and one in the lure. See that these wires are perpendicular to the back of the crest, and of equal length; place the crest in position upon the harness, give it a slight pressure, so that the points of the wires shall leave a mark upon the leather, then with a suitable awl pierce the leather where marked; insert the wires, press home, and clinch securely underneath the leather.

ARTISTIC FURNITURE

EASILY MADE AND CHEAPLY PRODUCED.

BY DAVID ADAMSON.

II.—A Screen Secretary.

(*Continued from page* 150. *For Diagrams, see pages* 148, 149.)

Lining of Writing-Flap—Mouldings—Flutes in Panel—Shaped Panel—Other Uses.

The writing-flap may be left plain, or, as it is technically called, unlined, *i.e.*, uncovered. It will, however, be better and more comfortable for writing on to line it either with cloth or leather. The latter is the more usual, but I must say I prefer cloth, as being softer. Leather is all very well when new, but it gets hard, and then one might as well write with nothing between the wood and the sheet of paper. Those who habitually use a blotting-pad will not be affected by either material, and except that custom requires a writing-table top to be covered, they may as well just finish the inside of the lid like the remainder of the work, either painting or staining it. If leather lining is preferred, skiver is generally used, though popularly known as morocco. Skiver, which is a split skin, does just as well, and is much cheaper. It can be got either from an upholsterer or a bookbinder, though the charge from the latter is higher than the former generally. Leather cloth must not be confounded with the real leather, though it too is often used. It is harsher to the touch, and, personally, I do not like it, except where cheapness is the prime consideration. In such a small surface, the difference in cost between any of these materials is very trifling, so the best, either leather or cloth, may as well be chosen. Any fine cloth, such as ordinary tailors' cloth, not "diagonals" or "tweeds," but the sort known, I think, as doeskins, with a smooth surface is suitable, and the colour is only a matter of taste. Dark greens and maroons are those generally used for the purpose, and most upholsterers can supply proper cloth. A "cutting" sufficiently large can easily be got for a very small sum, if the purchaser is not too particular about the colour or shade. Whatever the lining, it must be well fastened to the wood. Glue will do, but paste, strong as used by bookbinders and shoemakers, is better. Smear it on to the wood, not on the lining, rubbing it well and evenly. It may be done with a brush, but a method adopted by upholsterers is this: Wrap up some paste in a fold or two of open meshed canvas (Hessian or scrim) and rub this over the wood. The pressure causes the paste to ooze through the canvas, which retains any lumps there may be through defective mixing. When the

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surface is ready, the lining is laid on and pressed evenly and firmly down with the hand. Pray don't use a hot iron to expedite matters, especially if the lining is leather or leather cloth, unless its destruction is the object aimed at. If it is a very hot iron, it may be used with every reasonable prospect of perfect success in attaining this end. Properly applied, that is, with pressure of the hand or a cold iron, the paste will be dry in a few hours, when the edges of the lining may be easily trimmed off sharp to the edges of the board. Those who have bookbinders' tools will be able to roll a border, either gilt or blind, along near the edge of the lining, which, especially if leather, will be much improved in appearance thereby. It will be seen that the lining covers the whole surface of the writing-lid, instead of being surrounded by a border of veneer, as is usual in writing-desks and tables, and it is omitted as not only unnecessary, but in such furniture as the present, because, to put the matter in plain words, it is more trouble than it is worth.

So far as real utility is concerned, the thing may be considered finished, but there are certain purely decorative details which may be added; indeed, should be, if we wish to conceal the packing-case origin and crude, though serviceable, construction. It is astonishing what a few mouldings will do, and beginning at the top, let one such as that shown in Fig. 7 (see page 149) be glued and bradded all round. This is one got from Elliott, of Newbury, in whose catalogue it appears as *registered design*, No. 1071. It is very nearly the same thickness as the top board, the edges of which it should just cover, but if it comes at all below, it will not matter except in front. Were it to do so here, action of the lid would be prevented, and the moulding must be either shaved away, if only a small hindrance, or the top edge of the lid may be planed down till it clears the moulding. The bolt of the lock will, probably, still catch, but if not, a thin slip of wood glued to the top, just behind the moulding, thickening up the top equal to the moulding, will be all that is necessary. The corners of the moulding must, of course, be mitred.

Now, the surface of the lid strikes one as being too plain, and a little relief from the flat appearance will be an improvement. A small moulding glued on round the edge will make a great alteration, say Elliott's registered design, No. 1001, Fig. 8, but a more ornamental scheme is given in Fig. 9 (page 148). In it the moulding is shown glued down at a little distance from the edge. The centre is further relieved by a thin bevelled edge board on which flutes are cut. These flutes are merely hollows cut with a gouge, and the only thing it is necessary to say about them is that they should be kept clean and sharp at the edges.

Those who cannot manage to cut the flutes neatly, may not be aware of the pleasing effects which are got by merely shaping the outlines of such applied panelling (which, by-the-way, may strike the critic of art woodwork as being very shocking) and boring a few holes with a centrebit. Such a shaped and perforated panel is shown in Fig. 10, and in connection with it, the well-accepted principle that plainness is not so apt to be unpleasing as over-elaboration in design may be remarked.

What applies to the front may be said equally about the back, though there is no necessity why these two parts should be the same in appearance, *i.e.*, details may vary though some regard should be paid to harmony. It will be noticed that there is a difference in size between the two parts, and it will, undoubtedly, add to the appearance if a moulding, however small, is carried round the whole of the back panel. If desired, the small space behind may be enclosed, but made as shown, it will form a handy receptacle for various odds and ends. The upright shown in section is merely a piece of wood forming, as it were, a back to this opening, to prevent anything interfering with the free action of the lid. If this opening is not desired, of course, it can easily be closed, by bringing the back board or panel down to the bottom, so that it corresponds exactly with the lid in appearance. Both sides will then be uniform in appearance, but there will, of necessity, be some lost space. Even this might be avoided by reducing the width of the bottom till it is no more than is required as a stop for the lid, and utilising the space for a small sunk stationery rack.

This, however, would complicate the work beyond the scope of these directions, and it is hardly too much to say that, were all the ideas for alterations and modifications that may suggest themselves to be mentioned, it would, in a very short time, be found that a totally different piece of furniture, both in design and purpose, had been evolved. Still, one or two hints may not be unwelcome, and may serve to show how this screen can be converted into a still more useful thing. We have, say, a number of drawings, and we want a lock-up place for them; well, nothing easier than to enclose the lower part, that is, the space between the bottom board of all and the shelf. Let the back be fixed like the back of the writing-case, and the front fall down like the writing-flap; only, instead of it being hung with centre hinges, use a couple of ordinary butt hinges. Some may prefer a door opening in the ordinary way, when the interior may be fitted with two or three shelves and serve as a small bookcase. Again, others may like to form the space below the secretarial department into a cupboard, either with a fall-down front, or as suggested with ordinary doors. I have, however, not made the screen with either of these modifications, which are merely suggested as ideas to be worked out by those who may find them useful.

The "creature comforts" phase of utility I have already alluded to, and further reference to it is unnecessary.

WROUGHT IRON AND STEEL GIRDER WORK.

BY FRANCIS CAMPIN, C.E.

II.—Straightening and Bending Plates and Bars.

Although wherever straightening rolls are available they will be used in preference to hand straightening, yet, as in some circumstances there is not the option, it is necessary for the operative to be acquainted with the manipulation necessary to straighten or level the surface of a plate by hammering; if a plate is merely bent in one direction it is a very simple matter to hammer it out, but if there are bulges in it the process becomes one of greater nicety. The bulge itself must not be touched, as by hammering the metal would become thinner, and therefore rise more; on the contrary, by hammering out the plate all round the bulge more room will be given superficially for the material at that place, and it will thus be drawn out level, the amount of truth of surface attained depending upon the care and ability of the men employed upon the job. Of course it is understood that the plates are straightened cold.

In Fig. 3 is shown in cross section the arrangement of rolls in a plate-bending and straightening machine, for it will serve to curve plates as well as to straighten them. The apparatus is fitted with an upper roller, A, and two lower ones, B, B. These rollers admit of adjustment in relation to the vertical distances apart of their centres, and thus the plate, C C, passing through them becomes straight, or is curved as may be required; the curvature, however, only taking place in the direction in which the plate travels. In some straightening machines a greater number of rollers are used.

There has recently been introduced a machine for levelling very thin plates which should not be overlooked, for in view of the enormously powerful machines now being constructed for various processes of mechanical manipulation, it may follow that machines of this type will be produced powerful enough to deal with ordinary bridge plates. In the apparatus referred to the plates are firmly gripped by each end in powerful jaws, which, being then forced asunder by hydraulic pressure, stretch the plates, and in

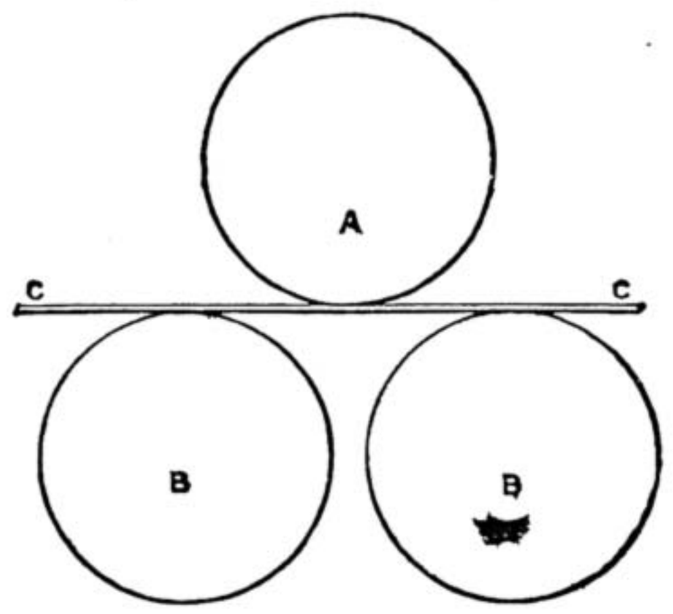

Fig. 3.—Arrangement of Rolls in Plate-Bending and Straightening Machine.

so doing take out any buckles that may have formed in them. In order to stretch the plates a force exceeding the limit of elasticity must be applied, and that for wrought iron is about eight tons to the sectional square inch, so for a plate 24 in. wide by ½ in. thick a pull of about 100 tons would be necessary. So long as no greater force is used than is necessary for the straightening it does not seem probable that the strength of the iron would be reduced by this process.

The bars of various sections, angle, tee, etc., will also require to be straightened, and this may conveniently be effected by pressure in a machine, the principle of which will be understood from the sketch plan shown at Fig. 4. A A is an angle bar, shown broken off, undergoing treatment in the machine; B, B, are properly-shaped blocks, against which the bar, A A, rests; they are solidly fixed to the bed of the machine. C C is a shaft driven by means of a belt on the pulley, D, and there is a fly wheel, H, at the other end to equalise the running. Upon the shaft, C C, is keyed a small toothed wheel or pinion, I, which works in gear with a larger wheel, K, keyed on to a second shaft, L L, upon which is fixed a strong eccentric, E. The revolution of this eccentric, which has a very small throw or stroke, drives forward the block, F, thus pressing upon the bar, A A, between the blocks, B, B; the extent of its action is

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regulated by raising or lowering the wedge, G, according to the degree to which the bar is bent; this adjustment is worked by hand. The action of this machine is by intermittent pressure for short periods, the bar being shifted as may be required between the

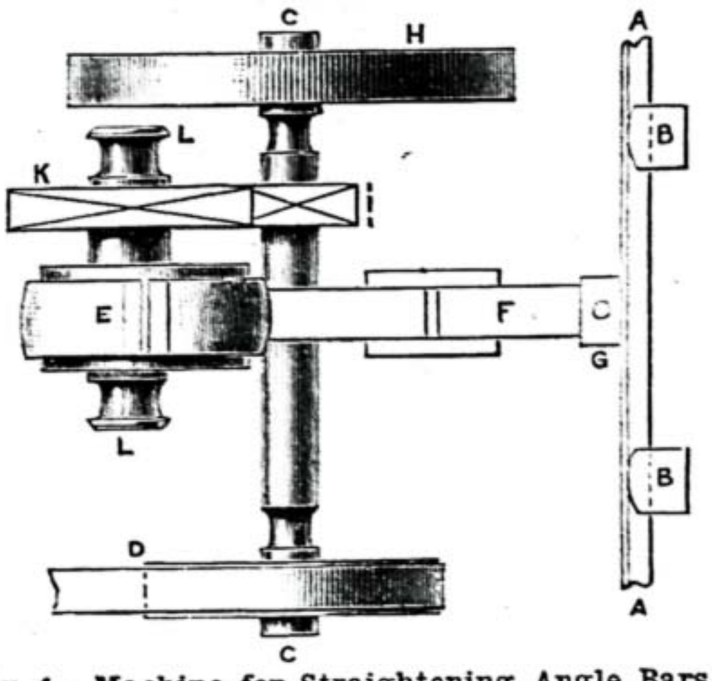

Fig. 4.—Machine for Straightening Angle Bars, T Bars, etc.

strokes. In the intervals of pressure the necessary momentum to impart it is stored up in the fly wheel, H, which gives it off when the resistance of the bar is met. From this simple form of machine much greater power is obtained, as towards the end of the forward stroke the pressure increases, until if resisted it becomes infinitely great. The bed requires to be very strongly made, its size and proportions being calculated in accordance with the strength of the largest bar it will be capable of taking, and the shafts and other parts must be in proportion, so that if anything breaks it shall be the bar and not the machine.

When angle and tee iron bars have to be curved or bent at an angle, the work must be done hot, as otherwise the normal angles of the sections would open, and in most cases the bars would crack at the root where the two limbs meet, and even when worked hot this opening will occur, and the bars must be hammered or pressed back to their original section. If the bar is made of uniform curvature throughout its length, and the curve is moderate, there will not be any special trouble from this cause, which is most noticeable in sharp bends.

If a number of angle irons are to be bent to a given curve, one is first so shaped, but to a curve so much sharper as to give the required form exactly to the others when bent hot upon it. Any slight opening of the angle can be set down by a few blows from a light hammer. In order to prepare the angle iron mould a template must be made, showing the curve it is to follow, and when of very large radius it cannot well be struck from a centre on the floor used for setting out work, but the arc required can be easily drawn by means of a bevel, the construction and use of which I will now explain. As a rule, all the curves used in girder work can be very closely followed by a series of circular arcs joined together, so if the length of each and its radius are marked upon the drawing, the foreman template maker need have no trouble in setting them out. There are a few simple properties of circles I will now point out, which will make the mode of procedure quite clear and fully explain its principles. In Fig. 5, G I H is a circular arc, of which O is the centre from which it is drawn, and I the centre of the arc. Now if from the points, G and H, two straight lines are drawn to meet each other at any point, P, in the arc, and two others are drawn to meet at some other point, P′, in the same arc, the angles, G P H and G P′ H, will be equal, no matter in what point in the arc the lines meet, so long as they are drawn from G and H respectively. If, then, we join two straight edges together so as to fit this angle, as shown at E D F, and put two pins, A and C, in the floor at a distance equal to G H, and fasten a pencil at the angle, D, then, by sliding the bevel thus made over the floor, keeping the edge, E D, against the pin, A, and the edge, D F, against the pin, C, the pencil at D will be caused to draw an arc of a circle, A B C, of the same radius as G I H. To be able to make this bevel we must know the length, G H, and the rise, Q I. These should both be marked upon the drawings, but very often they are not; then it will be necessary to calculate Q I. It will not do to scale it off the drawing, as any error so arising would be multiplied considerably in the full-sized template. The radius being known, divide it by one of the numbers in Column I. of the following table, selecting such a number as will give as a result a convenient chord length, G H, to work with. To find the rise of the arc in the centre of the chord, G H—that is, the length of Q I—multiply G H by 100, and divide the product by the number in Column II. opposite the divisor chosen from Column I. For example: let the radius be 116 ft.; take 8 as the divisor, then 116 divided by 8 equals 14 ft. 6 in., or 174 in., which is the length taken for G H; this multiplied by 100 is 17,400, and opposite 8 in the table we find the divisor 6,389; dividing 17,400 by this we get $2\frac{11}{16}$ in. for the rise, Q I, in the centre. Lay down the length 14 ft. 6 in. on the floor, putting in a pin at each end, and in its centre square up Q I $2\frac{11}{16}$ in., then G I H will be the angle to which the bevel must be made. The sides, I G, I H, must be prolonged to allow its apex, I, to approach the ends, G and H,

TABLE.

Col. I.	Col. II.
4	3,184
5	3,984
6	4,785
7	5,586
8	6,389
9	7,194
10	7,963
11	8,810
12	9,569
14	11,173
16	12,179
18	14,084
20	16,000

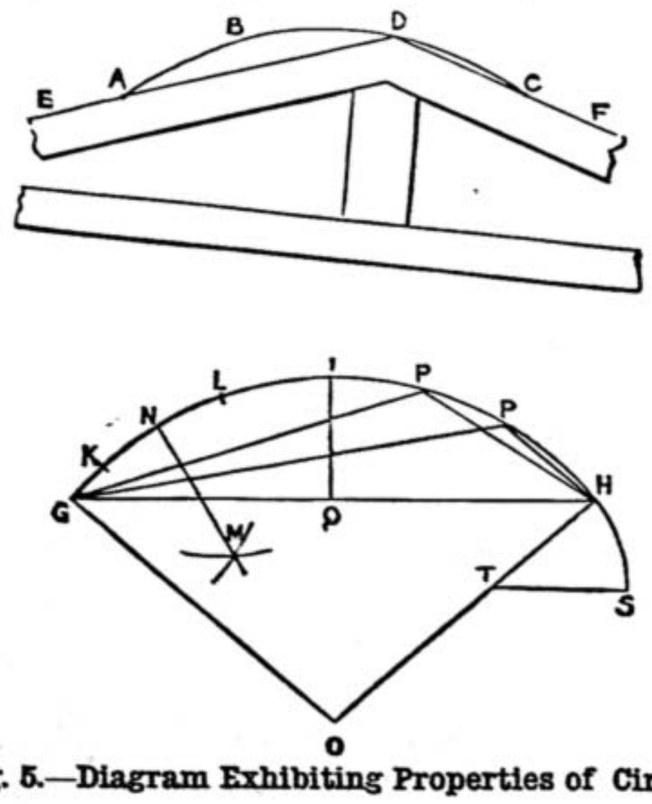

Fig. 5.—Diagram Exhibiting Properties of Circle.

without running off the pins. By means of this bevel the template can be made. I must now show how to shape the ends of the templates, so that the curves may be accurately joined at a change of radius. H S is an arc of shorter radius (H T, or S T), joined at H to the arc, G I H. In order that two curves may join without showing any break or distinct angle, the radii at the point of junction must coincide—that is, the shorter radius, H T, must lie upon the longer, H O. All that is required, then, is to mark the radius at each end of the template, then any two such templates being placed end to end, their curved edges will join accurately. The radius of a circular arc is drawn from any point in it as follows:—To draw a radius from the point, N, mark off on each side of it with compasses the equal distances, N K, N L, and from K and L as centres describe two arcs of equal radius, shown crossing each other at M, then a straight line drawn from N through M will be radial; and if two such lines are produced they will meet at the centre, O, of the arc. In order to allow the radial line to be drawn at the end of the arc, the curve must be carried a little further. In this case, N M would be the end of the template.

(*To be continued.*)

THE ORDINARY CHIMNEY BREAST:

ITS TASTEFUL TREATMENT AND DECORATION.

THE accompanying illustration is a suggestion for the artistic treatment of an ordinary chimney breast.

Nowadays, every young lady of ordinary talent is capable of depicting floral studies accurately and with feeling; it being quite a common thing for our youthful friends to send pictures to the Royal Academy, in many cases, unhappily, without a chance of their works being exhibited. It is a pity that so much meritorious work should be wasted, and it *is* waste both of time and money in the case of most young artists.

What I would propose to our young friends, as an outlet for their energy and talent, is the artistic decoration of their homes. Many of the flower paintings which are annually turned away from the Academy would form a pleasant relief to the panels of a door or window shutter.

My advice is that, instead of striving vainly for exhibition honours, they should devote a portion of their time and labour to beautifying the home. Why should they not paint the woodwork of their rooms in such delicate tints as egg-blue, terra-cotta, cream, etc., in preference to employing a man who is not an artist, and whose sympathies are not with his work?

The overmantel and chimneypiece shown in our illustration might be treated in plain tints, and then painted by hand in some tasty floral design. To begin with, the overmantel would have to be made in deal or pine, which would not be a very difficult undertaking for any moderately careful workman; then the entire woodwork of the room, including overmantel and chimneypiece, should be painted in one or more tints. A plain moulding would have to be run round the room at a distance of about 18 inches from the ceiling, to separate the frieze from the wall-paper filling, the frieze being either lincrusta-walton, hand-painted canvas, or ordinary paper.

The mantel valance is so simple that any lady could cut it to the required design, and embroider the pattern in crewels or silks. A few yards of gimp and fringe, and two small curtains sliding on a rod attached to mantel-board, complete the decoration of the mantelpiece.

The whole design admits of cheaper treatment than that illustrated; in fact, it is but a suggestion by which, I hope, some of the readers of WORK may be benefited.

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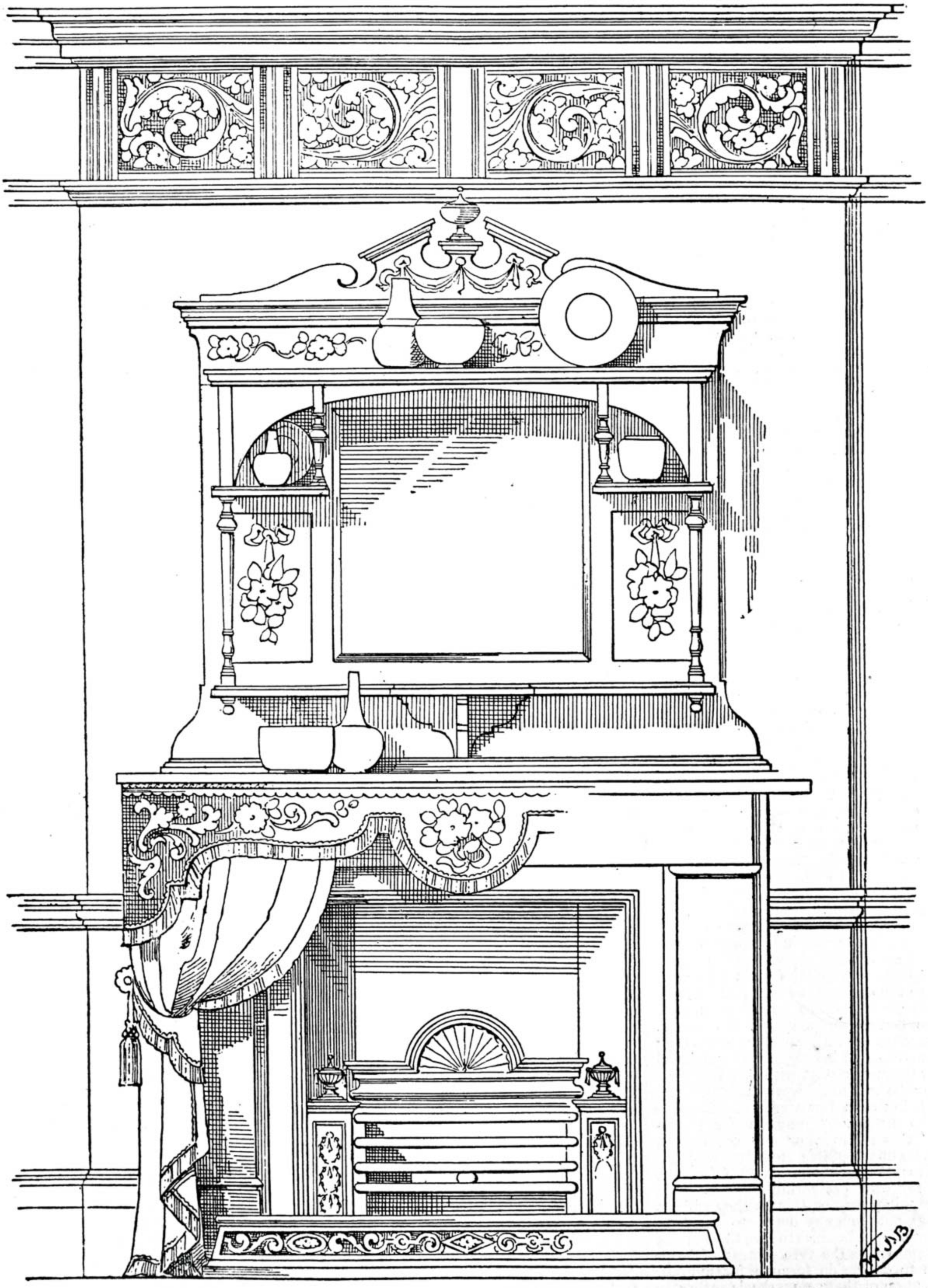

Artistic Treatment of the Ordinary Chimney Breast. Frieze in Lincrusta-Walton, or Hand Painted; Wall Paper, Sage Green; Woodwork of Overmantel, Painted White or Cream, with Hand-Painted Panels.

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PHOTOGRAPHIC DEVELOPERS.

ADVICE TO BEGINNERS.

BY L. IVOR POOLE.

THE tyro in the art of photography is not long in discovering that not the least of the difficulties which beset him is that of deciding on a formula for his developer. He sees so many of them given in any books to which he refers that it is no wonder he should feel perplexed. First of all he must decide whether he will use pyro, oxalate, or hydroquinone, the new claimant for favour, each of which is strongly recommended for his purpose. Then he must make up his mind on the host of minor details, and failing to do so satisfactorily, he applies to a friend who has made some progress. He will probably then have his doubts set at rest by being told more or less authoritatively that one particular developer is best. Armed with this assurance, he starts development with the formula recommended; some of his negatives turn out satisfactorily, but a good many of them do not. Some of them are flat, some thin, some too dense, and so on. The chief feature in which they exhibit some uniformity is that there is something wrong about most of them. Naturally he is enthusiastic about his hobby. He talks with others about his successes and failures, wants to know the cause of the latter, and how to avoid them in future. Some sympathetic friend is sure to be found willing to aid him and to give the benefit of his counsel. In due course the question of developer comes up. The friend probably remarks that another formula is better; he uses it himself, and perhaps brings out a photograph to show its capability of producing good work. The tyro is eager to try it, and vainly hopes by its aid to have good negatives henceforth, bright and clear, dense where required, quick printing, no stain, half tones and all the other qualities which combine to form a perfect negative. Disillusionment soon comes, for developer No. 2 is no more reliable than the other. Other friends are applied to and with like results. They get good negatives, but the beginner cannot, and so he goes on messing about without making much real progress in the art. He either becomes disgusted with photography or sends his plates to a professional to be developed. In the latter case a fair number of his negatives are satisfactory, and he will have some nice pictures to show. He will, however, know none of the true delights of amateur photography in the same way as the man who begins and finishes the photograph. His share of the work is almost limited to the exposure of the plate, a very necessary operation, but by no means the only one before the negative is finished. Such operators are rather plate exposers than photographers, and it may fairly be assumed that few beginners start with the intention of having the bulk of the work done for them.

This being so, a few words of advice to him who intends "going in for photography" this summer, or any other time, may not be unacceptable from one who *has* gone in for it for some time past. Of course, I have my own pet formulæ for different photographic processes, though they will not be named, not from any desire to withhold them, but simply because to give them might further embarrass the tyro instead of helping him to decide on formulæ for himself. The intention of these remarks is rather to indicate the general principles which should guide him, than to confine him to details.

First of all, let it be distinctly understood that there is no formula which is equally suitable for all purposes and under all circumstances; even if the ingredients admit of almost universal application, their proportions must be modified to get at all times the best results. With the chemical constituents of any developer the mental one of judgment must be largely used. Development is not a merely mechanical process, but is distinctly an art. The chemicals used are simply the tools, and their use may be very clearly demonstrable theoretically up to a certain point, beyond which the intelligence and skill of the operator must in practice carry him forward. Were it possible always to work under precisely the same conditions, such as unvarying activity of light, perfect uniformity in plates, temperature of the weather, etc., then indeed development might be reduced to a mechanical operation. As it is, it is no more so than that of an artist in painting a picture. A right comprehension of this, therefore, will save the tyro some disappointment, even if it does not help him to any great extent in producing a good negative.

Naturally, at first especially, a developer which allows of considerable latitude in time of exposure will be the most useful. A developer which cannot be modified to bring up an under exposed plate, or to restrain an over exposed one, cannot be so satisfactory as another which works fairly well, when used judiciously in either case. As a matter of fact, in the hands of experts there is no developer among those generally employed which does not admit of some latitude in exposure; but some are more easy to work with than others. That which can be most easily manipulated is of course the one which ought to commend itself to the tyro, who, however, must not make the mistake of supposing that with even the best of them in this respect the time of exposure is of no consequence. The best results possible can hardly be got unless the timing has been correct, though trifling errors, which are unavoidable, may be so far corrected that they are hardly discernible afterwards.

As the beginner is almost sure to try a pyro. developer, that is, one in which pyrogallic acid is the active agent, it may be said that he can hardly do better. If he cannot manage with it he is hardly likely to succeed with any.

Now comes the consideration of the particular pyro. developer to be used. The best advice I can give him is to choose a simple formula, consisting of nothing but the active agent, the pyro., a restrainer, usually a bromide, and an accelerator, such as ammonia. These are all that are actually necessary, and by varying their proportions it is possible to do almost anything that can be done in the way of development. Let therefore a start be made with the formula containing the fewest ingredients. By working with them, the novice not only obtains a command over the essential chemicals without them having been modified by the addition of others which, though useful in their way, are not essential, but he learns to appreciate practically the advantages offered by these. He has the rudiments of practical development on which to build his future practice, if he finds it necessary to improve his resulting negatives. He will not be long, for example, before he finds out that a pyro. developer such as described darkens and perhaps stains the negative. Of course, the stains may be removed, but that is hardly the question just now. He may wish to keep his pyro. in solution instead of weighing out and mixing it for each lot of developer, or lots of little matters may suggest themselves to him as being capable of improvement. As similar ideas of improvement have occurred to others, we get the numberless formulæ which have appeared, and however bewildering they may be to the novice, he must remember that each ingredient is advocated for a specific purpose, and in the vast majority of cases has had fair trial before it has passed the bar of photographic public opinion. It is, however, only the expert who can to the full benefit by such refinement, and no expert ever became one who could not do good work with the simplest formula. Though I have spoken of pyro., the same principles will apply to any other developer, as, for instance, the one which is causing so much stir just now in the photographic, or perhaps I should say, in the *amateur* photographic, world, viz., hydroquinone. No opinion is here expressed about the comparative merits of either or between them and other chemicals, whether used as developers, restrainers, or accelerators; but enough has been said to enable the beginner to form some notion of the kind of formula he should start with. He may be further advised not only to start with such a one, but to keep on with it till he has attained proficiency in its use, till he knows positively from experience in what direction he may reasonably require improvement on it. Stick to one developer will be a good rule for him to follow. Its peculiarities become familiar with practice, and by care he can manipulate the developer in a way to produce good results that might at first have seemed impossible. If on the contrary he chops and changes about, first trying one developer and then another, he gives himself no fair opportunity of thoroughly satisfying himself about their good or bad qualities and what they are capable of. He never gets to the bottom of them, and as no two developers require exactly the same treatment, he too hastily assumes that the fault lies in them rather than in his own inexperience. The amateur who makes progress in proficiency, and consequently in the pleasure of practical photography, is he who has learnt well one branch or mode of manipulation before proceeding to others. This, after all, is only common sense, but, as suggested in the opening remarks, the obvious advantages of beginning and continuing with a simple developer do not always occur till time has been wasted and experience gained.

But perhaps the beginner may think this rather confines him, and that were every one to act on the principle of sticking to one developer no progress would be possible. He would rather experiment for himself, and, if he can, add to the general fund of photographic information. Every one knows that the hidden mysteries of nature and art are only divulged by patient investigation, barring the usual exceptions which prove the rule, where they have been discovered by accident; and he is actually recommended to debar himself from any good which might accrue from scientific observation, or from profiting by a lucky accident. They are always possible, you know, and no one has discovered how to photograph in natural colours yet.

Such is by no means the intention of the present remarks, which are written to help the beginner, who will surely not overlook the fact that improvements in any art can hardly emanate from a novice in it. After he has emerged from his novitiate it will be quite time enough for original research to begin, and the more of it the better.

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OUR GUIDE TO GOOD THINGS.

43.—Glover's Machinery for Splitting and Bundling Firewood.

Almost everything, except eating, drinking, and sleeping, is done by machinery nowadays, and machines are contrived for the performance of household operations and many kinds of manual labour which our fathers invariably carried out by hand. Even for work of so simple—I might also say, so uninteresting—a character as chopping up firewood, machinery has been devised and patented by Messrs. M. Glover & Co., Potterdale Works, Dewsbury Road, Leeds, by which the work is effected with a certainty and rapidity in every movement which cause a considerable saving of time and labour. There may be some readers possibly who doubt the utility of describing such machines as these as foreign in some degree to the nature and scope of Work, but it must be remembered that every kind of machine is possessed of interest to the mechanic in the first place; secondly, that the illustration and description of machinery are often useful in prompting some inventive brain to the production of other machines of the kind distinguished by greater simplicity, perhaps, and additional power; and, thirdly, that the industry, in aid of which such machines are contrived, must be of far greater extent and importance than would appear at first sight to any one, either to do work of the kind or to see it done by means of the ordinary hand saw and hatchet. More than this, the mention of the machinery here may cause its introduction into union houses and other places where much of this kind of labour is done by aged men, who are far better able to watch and attend to machines of this sort than to apply their fast-fading strength to the performance of the acts of sawing and chopping.

In Fig. 1, the Patent Splitting Machine is shown, which is used for dividing the wood into small pieces, instead of the hatchet or chopping knife, hinged at one extremity to the bench and having a handle at the other. The wood is first cut into pieces or blocks six inches long, as shown to the left of the machine, the grain of the blocks being vertical or running from end to end. They are carried by means of rollers into the machine, and placed under a cross head carrying a heavy chisel, which acts in the same manner as the chisel of a mortising machine, falling on the end grain of the wood, and splitting it cleanly from top to bottom, the grain of the wood being followed in the stroke by the action of an automatic side spring placed in the feeding trough opposite the knife, partly to keep the wood in place, and partly to prevent any undue resistance that might be offered if the wood were held so rigidly in position that it would be absolutely unyielding when split by the chisel. When the strap by which the machine is set in motion is thrown off, the latter is stopped by a brake applied to the wrist pin disc. The size of the pieces into which the blocks are split is regulated by the rate of feed. The sticks as they leave the chisels are carried forward on rollers towards the Bundling Machine, shown in Fig. 2, the rollers acting as a kind of sieve through which all dust and dirt that may be adhering to the sticks fall from them. The sticks, as seen on the right of Fig. 1, are placed on a travelling band in the Bundling Machine, and carried into a box, where they are shaken together and gathered and compressed into round bundles by four formers, the ends having first been brought level by a plunger, which pushes the sticks up to a diaphragm which then withdraws. After compression into bundle form, the mass is forced from the box by another plunger, actuated by a cam, and forced outwards through a tube slightly convergent, and having a spring top in the manner and position shown on the right of Fig. 2. Here they are further tightened up by a band of steel drawn up by strong toggle-joint gearing, and the bundle is then wired by wire held by a clip above, which can be released by a foot lever. The ends of the wire are then twisted by the revolution of the clip, and, the bundle being completed, is pushed out of the machine by the next in order to be wired. Figs. 1 and 2 can be worked separately or in combination. The "Excelsior" Bundling Machine, shown in Fig. 3, is worked by the foot, and is intended for smaller requirements. The lever (7), fixed at the further end by the pin (8) on which it moves, acts by means of the vertical rod (6) passing through the bed or plate (1), secured by bolts to the table on which it is placed, and the toggle joints (4) on the sliding jaw (3), which moves into the fixed jaw (2) in front of it. By these jaws the sticks are compressed into bundle form, and are then wired or tied by hand, after which the bundle is released by the spring (5) below the stand. In this machine there is nothing in the form of ropes, chains, etc., that requires renewing, and time is saved in the rapid release of the bundles, which are made round, level at the ends, and of uniform size, by the action of the machine, which makes the work easy to the operator, and obviates the necessity of close supervision.

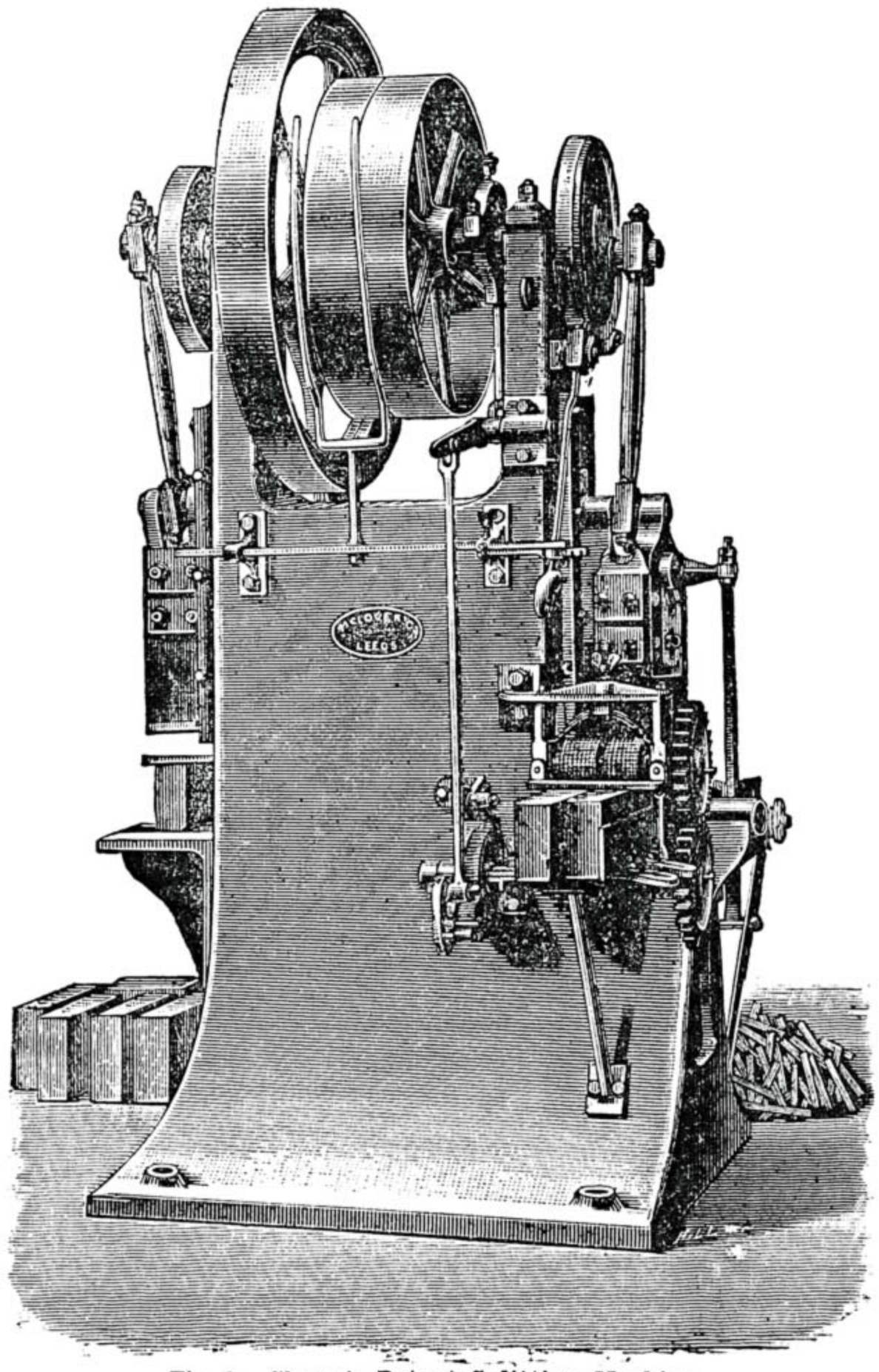


Fig. 1.—Glover's Patent Splitting Machine.

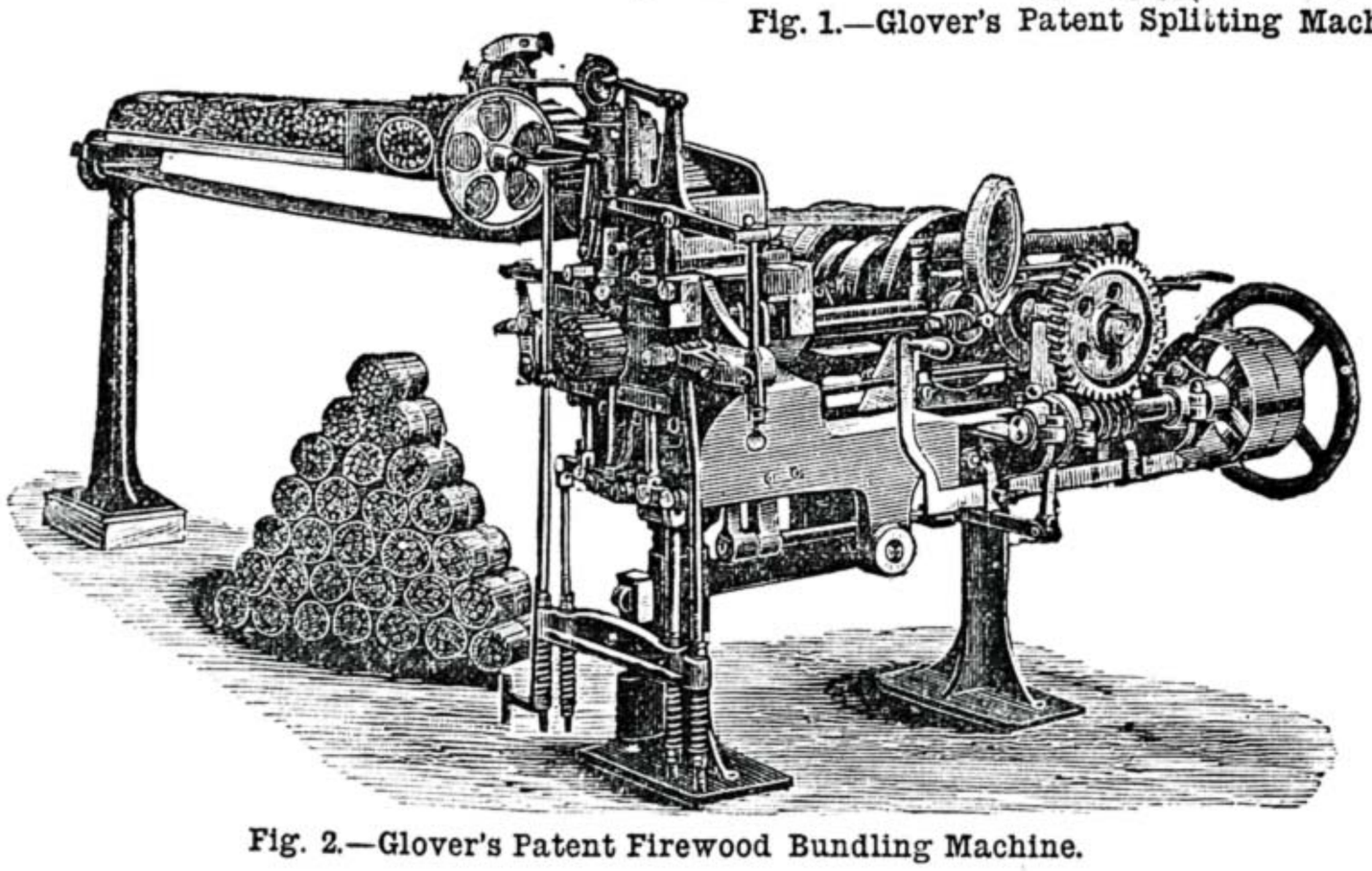


Fig. 2.—Glover's Patent Firewood Bundling Machine.

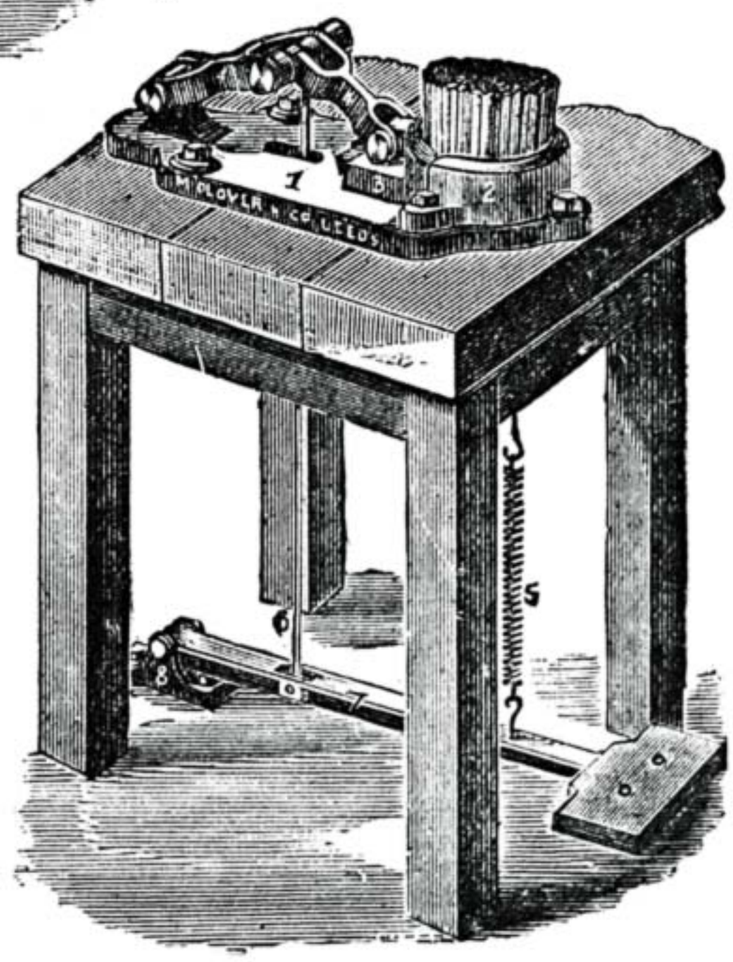


Fig. 3.—"Excelsior" Patent Firewood Bundler.

It seems at first sight somewhat marvellous that machinery of such size, power, intricacy of construction, and value, should be necessary for carrying out such simple operations as splitting and bundling firewood. Its very existence, however, proves the demand that there is in the present day for labour-saving apparatus, even for work of the most ordinary character. The Editor.

SHOP:

A Corner for Those who Want to Talk It.

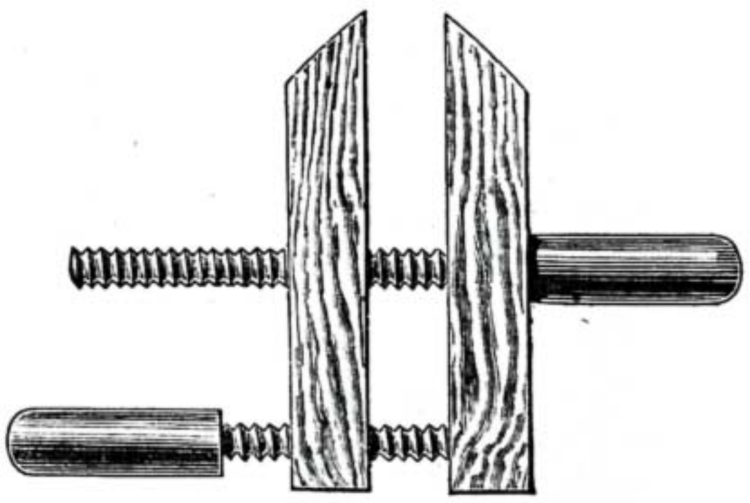
*** All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Circular-Saw Rigs for the Lathe.—A Foreman Pattern Maker writes:—"As the writer of the article on 'Circular-Saw Rigs for the Lathe,' I have tried to understand the meaning of your correspondent's criticism (G. E., *Camberwell*, p. 78), but in vain. He speaks of 'Fig. 1' as representing 'a superfluous amount of work for small results to an amateur in the screwing or tapping a chuck to obtain a counterpart.' From this I gather that G. E. takes exception to the trouble of cutting the thread in the saw spindle. But the same objection would apply with equal force to the fitting of lathe chucks of any kind. Fig. 3, without the thread, and made square ended for a square hole chuck, and lathe centres, is 'much better adapted,' but 'the square should taper 15°.' Well, I do not attempt to give dimensions, or taper to suit any particular chuck at all, and those who possess square hole chucks can make spindles to suit them. I simply give the general design. Again, 'the saw driven between centres of 60° is the most lasting, and less liable to run out of truth.' I don't see why a chuck like Fig. 1, tapped for the mandrel nose, should run out of truth any more than an ordinary lathe chuck. I know a wood turner who has been using spindles and saws, rigged like Fig. 2, for several years, without their running out of truth. And in the article, I advised steadying one end of the spindle with the poppet centre in cases where the fit of the thread may be imperfect. Besides, your correspondent should remember that a mandrel nose terminates in a collar, which helps to steady the chucks, and minimises the evil due to badly-fitting threads. I do not quite understand why G. E. thinks the table let into the rest socket the best. It certainly has the merit of simplicity, but I prefer Figs. 4 or 7, because they can be fitted with fence."—[The diagrams to which reference is made here will be found in No. 1 of Work, pages 8 and 9.—Ed.]

Metal Ball Making.—A Reader of "Work" writes:—"I should very much like to see an article on sheet metal press work in your valuable Work. It is a subject that does not seem to be very well understood by writers in technical papers generally. I once saw some hollow balls made from one piece of sheet brass, with only a small hole where the metal had been brought round to. I asked in one of our leading mechanical papers what tools and appliances had been used, but could get no answer. And then there are such things as military ornaments, some of which are quite works of art. I hope you will be able to see your way to insert an article on the above subject."—[Probably the balls you mention consisted of two hemispheres moulded by pressure, or produced by a process known as "metal spinning," and then joined edge to edge and neatly brazed or soldered together. Perhaps some reader may be able to give you the information which you failed to get from the quarter indicated, in the form of a letter, etc.; if necessary, a paper describing the means used.—Ed.]

Sharpening Carving Tools.—J. W. B. writes:—"In No. 7 of Work I notice a reply to Tom on the mode of using slips to sharpen carving tools. It is a very dangerous way to attempt to do this by holding the slips in the hand, or even on the bench,

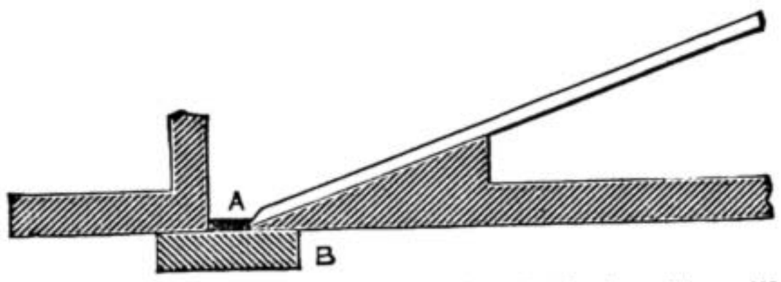


as the tool may slip as well. A much better way is to secure the tool in a hand screw (shown in illustration), and then fix the latter in the bench vice.

A Good Word for Work.—Dulcimer writes:—"I have taken in Work since the commencement of its issue, and have circulated the copies amongst friends, who have almost, without exception, determined to become subscribers. I think no one can do less for a work which will probably have more effect in rendering home healthier and happier than any legislative measure can do. The various ways in which this can be effected need no comment."

"Disgusted Abandonment."—E.C. (*N. Brixton*) writes:—"Buying No. 6 by chance, seeing its bookbinding diagrams, I ordered No. 7, in reasonable expectation of its being concluded or continued *seriatim*, but it is neither so, nor any intimation present or future; so, though it may be imagined a bond of continuance, it may equally end in disgusted abandonment, if one can never reckon on things being *regularly* carried through. Perhaps washing would not be thought work, else there is a new system with solid paraffin used which would be of general interest."—[I hope you are now buying Work regularly, as you ought, and have come on the continuation and conclusion of "Binding made Easy," which duly appeared in No. 9. For my part I think the expectation of continuation of any subject from week to week the reverse of reasonable, for many reasons, the chief of which is that if such a course were rigidly followed, variety would be unattainable. Be assured that nothing once commenced will ever be discontinued, save under circumstances that are not influenced by human control, such as the death of a writer before he has completed his subject, and even in this case another would be sought to gather up the broken threads, and carry out the work. The ladies say—especially those who take it in hand—that washing *is* work, and hard work too. So if you will kindly enlighten those who buy Work—and I believe there are many who do—with an account of the new system, they will be sincerely obliged to you. The fact of your writing shows that there will be no "disgusted abandonment" of Work on your part, but that you are on the look-out for a rejoinder to your remarks. Well, here it is.—Ed.]

Pattern of Plane for Casting.—E. P. W. writes:—"I have read the article on home-made planes, and I think it is my duty to mention that when a pattern is made for a casting, it should not be cut quite through, and there should be a thin piece glued or tacked on to the pattern where the mouth is to be, because it is difficult to have a clean casting when the mouth is cut through, and the part that forms the bed for the iron, being very thin, cools very



quickly, and is sometimes so hard that a file will not touch it. This will prevent it, and there will be no trouble in chipping or grinding the projection off, and then when the casting has been planed or filed up, as the case may be, the mouth will be through, and there will be no trouble. I hope the writer of the article will not be offended, as I do not write this to offend him, but for the benefit of any one that may be following his instructions, and be fixed, as I have been. I speak from experience."

Work's Utility.—F. E. writes:—"As one who has benefited by your Work, I feel constrained to inform you that I too made use of No. 1 (though not the cabinet), but I made one of Mr. Adamson's tables, putting the shaped top on to the shaped stand, which, after being enamelled a pink colour (probably terra-cotta would have been better), I found was a pretty table, acceptable to my employer. I hope you will, in due course, treat of the *Upholstery and Polishing Trades*, in which I am more immediately interested. The articles by Mr. Denning and those on the cutting, etc., of tools, I regard as especially good."—[We are all glad to know that No. 1 of Work has proved genuinely useful to you. I am sure that hundreds of workmen will find it useful in the same way—namely, as a mine from which to quarry ideas. Try the overmantel in No. 2. Upholstery and polishing will be treated in due course.—Ed.]

Tube Saws for Ivory.—F. A. M. writes:—"Many of your readers will envy me when I tell them I have just paid a visit to the workroom of a famous ornamental turner, Rev. C. C. Ellison. Amongst the many interesting things were some tube saws for cutting blocks of ivory into cylinders with the smallest possible amount of waste—a most important object with ivory at its present high price. Those who have read Mr. Evans's book on 'Ornamental Turning' will remember that it contains a description of some bent cutters for use in the spherical slide rest, contrived by Mr. Ellison for cutting a number of hollow half spheres out of a solid one; these tube saws are the complementary tools for similar use where cylinders are concerned. I was first shown a series of ivory cylinders about $\frac{13}{16}$ in. thick, one within the other, and at least 4 in. long, whilst there was only about $\frac{1}{10}$ in. between the internal diameter of one cylinder and the external diameter of the one within it. Evidently a parting tool could not produce such work. A little further on I came upon a set of cylindrical or tube saws, and the secret was revealed. Mr. Ellison procured a set of solid drawn steel tubes from the Credenda Steel Tube Works, Birmingham. The length of the smaller, from 1 in. to 2 in. in diameter, is 6 in.; the larger sizes, from 2 in. to 4 in. diameter, are 9 in. long. These tubes, being too stout, were reduced by turning to about half their original strength, when they became from $\frac{1}{40}$ in. to $\frac{1}{20}$ in. in thickness. The pitch of the teeth, as well as the thickness of the saws, gradually increases with the size, from $\frac{2}{10}$ in. to $\frac{3}{10}$ in. from point to point, and the teeth are set rather upright. The saws are advanced into cut by the back centre, whilst the block of ivory revolves in the lathe. A shouldered cylinder of hard wood is fitted into the hinder end of the saw, which piece of wood has in it a conical hole to receive the point of the back centre. A groove is cut with a parting tool in the face of the work to form an entry for the saw, which must be wet when the material operated upon is ivory, and the saw has to be frequently withdrawn to clear it of cuttings. Mr. Ellison considered the saws could not be so well made by bending round and brazing a saw blade. Perhaps some practical workman who sees this will give an opinion upon it; and possibly some firm of tool makers will be found to undertake the manufacture of such sets of saws, and will tell us what they think they can be supplied for."

Fretwork Cabinet.—Engine Driver writes:—"I feel quite jealous of the honour you have bestowed on T. F. of being the first to use No. 1 presentation plate. I had finished a fretwork cabinet on the 20th, and would have wrote telling you of it, only I had used a cigar box for my fretwork (don't let Mr. White know this). However, I have got a real nice cabinet, and you will please give Mr. White my humble thanks for his beautiful design. I must also thank Mr. White for his 'tip' for ebony staining, and Mr. Denning for his valuable hint for mixing glue. I could never make glue stick until I read his article, and now I think I could make glue that would make an M.P. stick to his promises. I wish you every success, and have to tell you, by the way, that six of my shopmates who have seen my cabinet intend to get Work regularly."

Cabinet in Fretwork.—T. F. (*Willington-on-Tyne*) writes:—"I thought I would just like to write and let you know that I did not allow the little difficulty I met with in commencing to make the first cabinet dishearten me; far from it, for I never allow any sort of fretwork or plain inlaying to be my master, and when first I got sight of the cabinet pattern in No. 1 of Work, I took a great liking to it, for it is the very best I have met with, and as the designer said it was certainly worth doing well. So I thought I should like to let you know the trouble I am going to to make it, as near as possible, a success and a good finish. In the first place I have used up four of the cabinet patterns during my experiments. First I cut out one door $\frac{1}{16}$ in. thick, and filled in with a composition of different colours, using the proper system of indicating colour: red for the flower, yellow for the stem, and green for the leaf, but this did not please me. So then I tried another door, in plane tree, which is white. I cut the pattern all out first, and then I stained the glue quite black, and glued the pieces, and put them all back again, and when it was cleaned up the black glue showed the line of the pattern up something nice, although this was not quite to my taste. So now I am inlaying the three right-hand doors with plane tree laid into a walnut ground, and the three left-hand doors are being inlayed with walnut into a mahogany ground, so I think it is as near to perfection as one could get it. I forgot to say that I tried very thin wood, but it does not bring the pattern out so well as my last experiment, but of course a lot of patience is required, and unless beginners in fretwork or inlayers are not prepared with a lot of patience and time, or if they do not take a delight in the art, they had better not commence it. I have been now twenty-two years at fretwork, and my patience has never once yet run short, although I have many times been weary in it but not of it. Here is a proof of the trouble and time I have been to. I once, while I was in China, made a basket called the stag hunt; it took me many months to finish it, for there were over 1,500 cuts in it, and some of the pieces as small as a pin's head. How many beginners in fretwork are there who would go to the trouble of first cutting that pattern out with his penknife—for I have that pattern still by me—and then paste it on to wood, and then cut it out with his fret saw, making altogether 3,000 cuts, and still have his patience as fresh as ever? I should like some day, sir, if I can find time and you space, to let you know, or rather your readers, how I treat my fret patterns, for I never destroy them; some I have had by me this twenty years, just the originals as I bought them. I have two books full, and they are very nice scrap books to look at. I have never fell across any one in England who treats these patterns as I do, but of course there may be some who do."—[Your patience and perseverance are remarkable, and eminently praiseworthy. By all means let us know how you treat your fret patterns. The knowledge will be useful to many readers.—Ed.]

Something Cheering from Kerry.—Iernus writes:—"Being a subscriber to the *English Mechanic* for some short time back, I happened to see in an issue of that paper of about the 1st March last an advertisement of Work, and seeing that it seemed to be the kind of paper I wanted, I sent to Dublin for a number of it, and it turned out to be indeed all I could desire. So you see the first number of your paper found its way even to 'the wilds of Kerry.' I need not tell you I have continued to get it since, and that I will recommend it to all whom I can. I am sure some articles on speculum grinding, and silvering and telescope making, would be very acceptable to many besides myself. Perhaps Mr. Bonney would be kind enough to give us some articles on telephone making. I must mention with regard to all articles which have appeared in Work up to this that they are all as clearly written and as useful as any one could desire. I may say, in conclusion, that I wish a long and prosperous career for Work."—[Thank you for your good wishes and commendations of Work. I am glad to say that Irishmen are numbered among the contributors to the Magazine as well as among its readers. On my staff are writers of ability and experience on the subject you

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name, and these will be taken up as soon as opportunity offers. Meanwhile, ask any question in reference to either, or both, of them, and your inquiries shall meet with the best replies that can be given.—ED.]

Touching "Shop."—G. P. B. (*Darlaston*) writes:—"Having taken in WORK from the commencement, and being immensely pleased with it too, I desire to add my little meed of praise to that you have received from so many correspondents. I have been particularly struck with your 'Shop' column, and the courteous manner in which all letters of inquiry on a vast variety of technical questions have been answered week after week. Although I, too, have many questions to ask I refrain for the present, seeing that this week you have more questions to reply to than ever, but before long I shall have to trouble you. In the meantime may WORK go forward and prosper as it deserves to do; the very fact that so many apply to it for advice proves conclusively how much the venture is appreciated, and that a long and useful career is assured."—[I do not know that I deserve your commendation for courtesy in replying to letters of inquiry. I should be sorry to be otherwise than courteous to any man living. It is my belief that it is by kindness in speech and manner that one chiefly obtains influence over others. Believe me when I say that in all I say in WORK or do with respect to it, I am chiefly actuated by a wish to be useful in and to my generation, God permitting. Ask what you will, when you please, and, if possible, an answer shall be forthcoming from one of my staff or myself. Failing this—for we do not pretend to know everything, either individually or collectively—your queries shall be submitted to WORK'S readers at large, in the hope that one or other of them will be wiser than we on the point. It is impossible to put more than a quart into a quart measure, and equally beyond possibility to put more into WORK'S sixteen weekly pages than what they contain at present, having regard to legibility, etc. I suppose WORK will have to grow in superficial area one of these days.—ED.]

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Type: How Made.—ELECTROTYPE.—Types are cast in moulds from type metal, which is a composition of lead, antimony, and tin, in various proportions according to the size of type.

Work on Electricity.—ELECTROTYPE.—Possibly the best work for your purpose will be "Electricity in the Service of Man," edited by Dr. Wormell, now publishing in monthly parts at 6d., and of which three parts are published to the present time.

How to Obtain a Patent.—A. D. (*Bury*).—In the reply to a correspondent to which you refer, £1 10s. was inadvertently or accidentally written for £1. At the Patent Office, 25, Southampton Buildings, Chancery Lane, London, W.C., a "Circular" may be obtained giving all information on the course to be taken to obtain Patents for Inventions in the United Kingdom. Possibly you will wish at first to obtain provisional protection. This lasts for nine months, and during this time you can be developing your patent with the view of obtaining complete protection at the end of this time. Or you can obtain complete protection at once. If you merely require provisional protection the fee is £1; with another fee of £3 for complete protection at the end of nine months. For complete protection at first the fee is £4. You can obtain the form of application through any money order office at a few days' notice, and by prepayment of value of stamp. At Bury, where you reside, you may obtain the necessary form at once from the head office on application, and payment of fees, for I note that Bury is named in the list of places in the United Kingdom where forms of application are kept on sale. The "Circular" to which I have alluded above, and which is obtainable at the Patent Office, will afford you all other information in detail.

Kit of Carpenters' Tools: its Cost.—COST OF TOOLS.—Anything relating to practical work is worthy of attention in this column; but I am afraid very little in the way of direct answer to your questions can be given. First, it is impossible to say what constitutes a complete outfit. If you make a "hobby" of your tools you may run to any cost you like; and, on the other hand, you may get a very fair assortment for general work for a very few pounds. At the most, the outlay at any one time is not heavy, if you go the right way about it, just adding a tool as you find it advisable, or as opportunity occurs for getting what seems likely to be useful. The quantity and style of tools also depend a good deal on the class of work to which you devote yourself, and whether you have one or two good-natured shopmates who are willing now and again to lend a youngster some out-of-the-way tool he may not possess. In many shops no tools at all would be required at "just starting," for the simple reason that the work is almost confined to attending to, and waiting on, the men; but you may, I think, take it for granted that for the first twelve months a sovereign would well cover your outlay for tools. Much, however, would depend on what your employer or foreman might consider necessary, and this you can always ascertain before being engaged. If you go "on trial" for, say, a month, you would not probably be expected to possess any tools during the probationary period. You will thus see the difficulty of giving you definite answers, but what I have said will, no doubt, be of assistance to you.—D. A.

Practical Method for obtaining the Bevels of a Bevelled Hopper or Box.—X. Y. Z. (*Orkney*).—The reason that this question presents some difficulty to the average mechanic or amateur is because the sides are not at right angles or upright with the top or bottom, as the case may be, but bevelled. If the angles of the box or hopper were square, it would be simple enough, and all that would be necessary would be to set a bevel or square to the bevels or joints required. Fig. 1 given herewith represents the section of one side

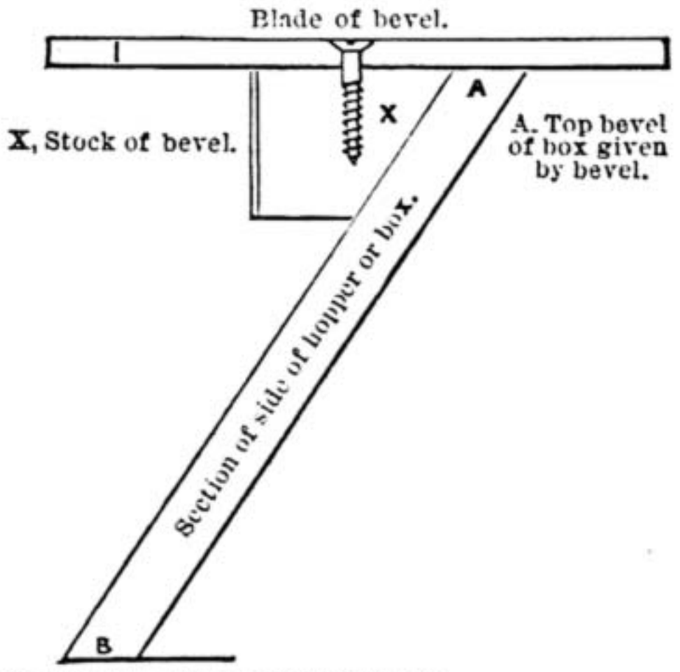
Blade of bevel.
X, Stock of bevel.
X
A
A, Top bevel of box given by bevel.
Section of side of hopper or box.
B
B, Bottom bevel of box given by bevel.

Fig. 1.—Section of Side of Bevelled Hopper or Box.

of a bevelled hopper or box, and all that is necessary is to make a simple wooden bevel, with one side of the stock bevelled, as shown at X, to the splay required, and set the blade of bevel to the necessary angle, as if the sides of box were upright with the bevelled side of stock against the work (always setting angle of blade of bevel from the square or upright side, which is marked darker in the diagram). Fig. 2 represents the plan of bevel,

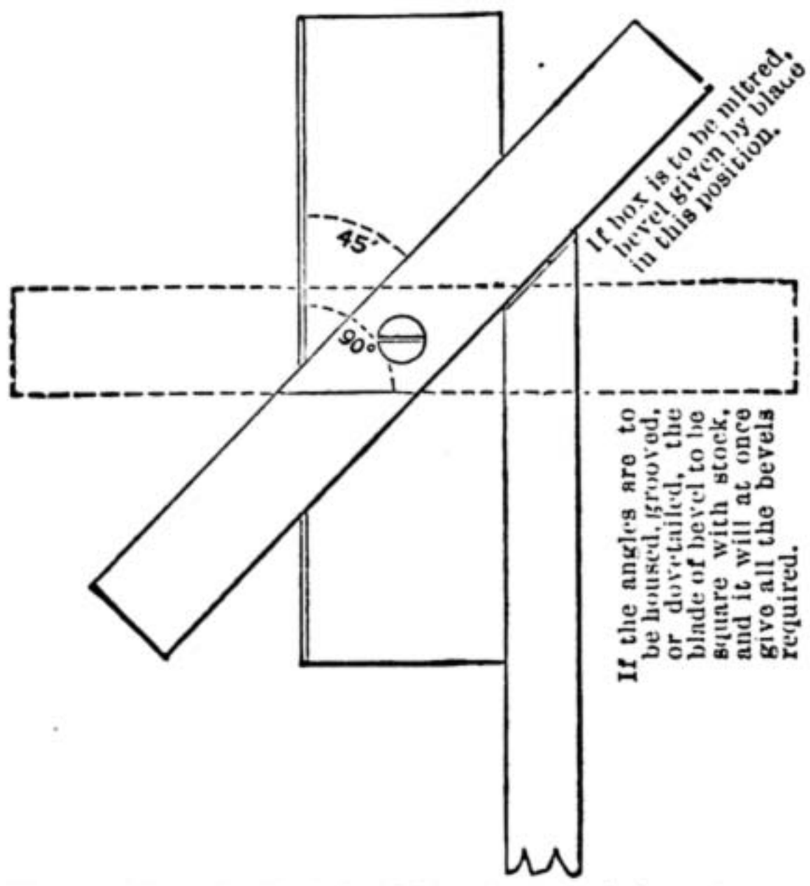
45°
90°
If box is to be mitred, bevel given by blade in this position.
If the angles are to be housed, grooved, or dovetailed, the blade of bevel to be square with stock, and it will at once give all the bevels required.

Fig. 2.—Rough Sketch of Bevel, for giving at once all the Bevels required for making Bevelled Hopper, Box, or Splayed Window Linings, etc.

with the blade set to an angle of 45°, or, practically speaking, a mitre, and shows the method of applying same to mark the mitre of angle—that is, if the hopper or box is to be mitred. If the angles are to be dovetailed, housed, or grooved, the blade must be set to an angle of 90°, or square, just the same in all respects as if the hopper were square, with the one exception that one side of the stock of bevel is splayed to suit the splay of hopper required. Fig. 3 shows the method of cutting out

Fig. 3.—Showing Method of Cutting out Sides of Box to save Material.

the sides to save waste of material, and it will then be seen that after cutting and turning two alternate pieces upside down the angles will coincide. Of course, if the angles are not to be mitred, allowance must be made at each cut for overlapping. If X. Y. Z., after getting his stuff to the proper width, first bevels the top and bottom of his sides (the position of bevel, in Fig. 1, determines these bevels), and then marks the splays required, as Fig. 3, he will, on applying the bevel, at once see the simplicity of this method. The same rule also gives the bevels for the angles of splayed window linings, and that much-discussed problem—the bevels of a washing tub.—E. D.

Preparing and Polishing Wood.—G. W. (*Bermondsey*).—A series of articles on this subject will appear in due course; but, pending their publication, I shall be happy to help you in this column if you will let me have particulars of what you want to know. It would be of the very greatest assistance if you and other inquirers would state the kind of wood and the style of finish desired, as at present to answer the question fully would require a complete treatise. For example, I do not know whether your things are pine to be stained to imitate some superior wood; then whether they are to be polished or varnished, or whether they are of wood—say mahogany—to be finished bright or dull, darkened, or natural colours, etc. If you will write again I shall be pleased to tell you, as you are quite right in supposing that I am prepared to help workers; but, of course, before I can do so, it is necessary I should know as many particulars as possible. With these in hand, you may depend on getting reliable directions.—D. A.

What to Do, and How to Do it.—W. H. M.—You say, "I am in the Post Office, and have a lot of spare time on my hands, and feel that that time is absolutely wasted, having next to nothing to do; so what I have long desired is to learn something about joinery and carpentering, and I wish I could get to know some carpenter or master from whom I could obtain some knowledge in return for any services I could render." From this I gather that you are a letter carrier, and have spare time between the deliveries that you wish to utilise. If I am wrong, forgive the incorrectness of the inference; but reading between the lines of your letter, I am led to this conclusion. Well, you seem to be possessed of a little ready money as well as spare time, and if this be so, spend a guinea or two with some friendly carpenter that you may learn how to hold, use, and sharpen your tools, and go through all the preliminary exercise in carpentry, in which, however, you can only attain perfection by practice. You will subsequently find it has been a guinea or two well spent. As to tools, buy good ones. You will often pick up excellent tools at the unredeemed pledges' shops—the pawnbrokers—and even the marine store dealers'—otherwise known as "rag and bone shops." Never mind if they look a little the worse for wear; an hour or two spent in furbishing them up, cleaning, polishing, and refitting, will work wonders, like old Time, and lend quite a new aspect to things that looked dingy, battered, and next to useless. A little money goes a long way in second-hand tools, and by care in selecting and buying, you will soon gather together a very decent kit. Buy anything that is cheap and worth having, whether you want it immediately or not. Everything, don't you know, is useful once in seven years, and I am sure this applies particularly and especially to tools, for I never yet bought a tool that did not come in handy at one time or another. Once I bought a capital hardwood bevel for 2d. that I use to this day. Having got a few tools—a hand saw, tenon saw, rule, square hammer, jack plane, smoothing plane, half a dozen chisels, and some bradawls and gimlets of different sizes, are indispensable—and having learnt how to handle them, look out for a few jobs in repairing, and make for sale some of the pretty things that are described and illustrated in WORK—such as the Summer Fitment for the Fireplace, in No. 9. If you are a letter carrier, as I suppose you to be, have some cards printed when you are skilful enough to work in a workmanlike manner, and leave them at houses where you are in the habit of calling; you will soon get a connection. And if you are a householder, and have a handy window, put a few things in it on sale—such as a gipsy or fancy table, two or three brackets, and other pieces of work that are likely to take the fancy of those who have money to spare and spend. Very simple instructions on lathe making will soon appear, from the pen of a "born lathe maker."

Wood Engraving.—T. O'C. (*Plumstead*).—You say:—"I have a fair knowledge of drawing, and in order to make that knowledge marketable, I want to work it up so as to draw for the various illustrated weeklies—to become an artist on the staff, not an occasional contributor." To become "an artist on the staff" you must be possessed of a decided talent for drawing; and if you can really draw well, you might submit some sketches to some of the powers that be on the illustrated papers. At the same time, I must warn you that there are many others on the same trail as yourself—prospecting for happy hunting grounds in this direction. To be an artist, you need not be practically acquainted with wood cutting and engraving, but it is decidedly of advantage to an engraver to be able to draw. I am not acquainted with any good book on wood engraving, but I think I may venture to say there is one on the road, which, I trust, will find publicity in WORK. I am sorry I cannot give you better advice than to first catch your editor of an illustrated paper with inducements and enticements in the form of well-executed and taking sketches. This is the hardest part of the business, as you will find, but having landed your editor, the rest is comparatively easy.

Upholstery.—A. S. (*Edinburgh*).—Complete and thorough instruction will be given on this subject in WORK, as well as on all things that are more or less directly connected with it.

Glue-Paste.—J. G. (*Stanningley*).—Paste mixed with glue—*i.e.*, glue dissolved in the hot water when adding it to the flour—will be found sufficient, as glue for so large a surface is difficult to manage.

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Bronze Powder.—I. G. W. H. (*Uxbridge Road*).—Hughes & Kimber, West Harding Street, Fetter Lane, supply the bronze powders in every shade and quality.—J. G. G.-W.

Bunsen Battery.—ENGINEER writes to point out a clerical error in the second article on the Bunsen battery. On p. 22, second column, near the bottom, instead of "·08 volt," read ·08 ohm. Thank you for your kindly criticism. It was merely a slip of the pen, as you will observe by comparing it with the calculations just below the line in which it occurs.—G. E. B.

Model Making.—BABY MODEL MAKER.—I must answer one question by another. What kind of model do you require? Of what do you wish to have a model? Model making covers a tolerably wide field, and although I have nothing whatever to urge against model making, I cannot help thinking that what is now appearing will prove of equal assistance to yourself—a youth of fifteen, in the first six months of your apprenticeship—and your fellow-apprentices. You say you think WORK "ought to centre more on wood and metal working and trades. Such topics as (Bunsen) electric batteries, painting photographs, and electro-plating, are rather out of the proper sphere and mission of WORK, and are only interesting to a very small portion of the readers, while to the large majority of wood and metal workers it is of no use." It is not probable that everything that appears in the pages of WORK will be equally welcome to every reader; but I may say, that on the principle that everybody is somebody's darling, or ought to be, so every pursuit is somebody's hobby. Take up one of the subjects that you look on as being of no use to you and make it your hobby. It will widen your experience, and, perhaps, some day, when you may least expect it, it will prove of positive use to you in the money-earning point of view.

Index to Numbers of WORK.—INDEX.—I am obliged to you for your suggestion, which is noted for adoption, if it be found necessary at any future time. As each number of WORK consists of separate papers of some length, and not of a number of short paragraphs, "a condensed index of the contents of the number" seems scarcely requisite. Mostly each article is headed with a brief synopsis of its contents, which is indirectly an index to its subdivisions.

Composition for Raised Ornament.—H. S. F. (*Worcester*).—If the ornament is only to be slightly raised on the card, etc., for the display of gilding or bronzing, a raising composition is sold for the purpose by artists' colourmen, or one may be made by mixing whiting, flake white, and gold size. If the card or paper be quite smooth, roughen it a little with the edge of a knife, and the composition will stick. Paint it on with a camel-hair brush, which should be kept well filled at the point to flow properly; the composition should be as thick as treacle. Successive coats, with intervening dryings, can be laid on till high enough. It makes a good ground for gilding upon. If the relief is to be considerable, and on wood, etc., it may be well to satisfy the grain of the wood with linseed oil, to prime it with linseed oil and whiting, and to model the ornament on in a putty composition (whiting and linseed oil). Flake white added to this will make it set harder, but it is poisonous. A better composition for modelling ornaments for fancy articles is said to be plaster of Paris, with 2 per cent. of powdered althea root. This can be worked upon for an hour, after which it sets as hard as ivory; but more difficulty might be found in making this stick to the board.—M. M.

Advertisements in WORK.—R. G.—Your suggestions shall receive attention, and shall be adopted if possible.

Organ Building.—R. B. (*Salford*).—The subject of American organ building will be taken up first, and that of making pianos. I do not think it likely that instructions will be given for making a barrel organ.

Artificial Legs.—BERNHARD.—I must draw the line somewhere, and I think I must draw it in one direction at artificial limbs, legs, arms, and eyes as well. The only man I know whom I could ask to write on the subject is Mr. James Gillingham, of Chard, a specialist of the highest order on this branch of manual and mechanical work, and he is far too busy at all times to put pen to paper. It may be that this may meet the eye of some one who is suffering, or who has friends suffering, from loss of limb, spinal complaint, distortion of any kind, etc. All such as these I strongly recommend to send for Mr. Gillingham's book, which will show in how many remarkable cases he has been most helpful and most successful.

Model Steamship' Construction.—M. M. (*Glasgow*).—I will not pledge myself to a series of articles on this subject, but I may say that papers are in preparation on a steam launch, which will afford instructions on the method to be followed in building such a vessel from beginning to finish.

Sounding Board of Dulcimer.—DULCIMER writes:—"I should feel obliged if you would inform me of the proper dimensions for the sounding board of a dulcimer of twenty-one notes, eighty-four strings. Of course the frame would be on the same angle. I think a description of such an instrument would be welcomed by many subscribers, as it is easy to make and to play when made."—[If any writer likes to send in a paper on the construction of the dulcimer on approval I shall be glad to receive it.—ED.]

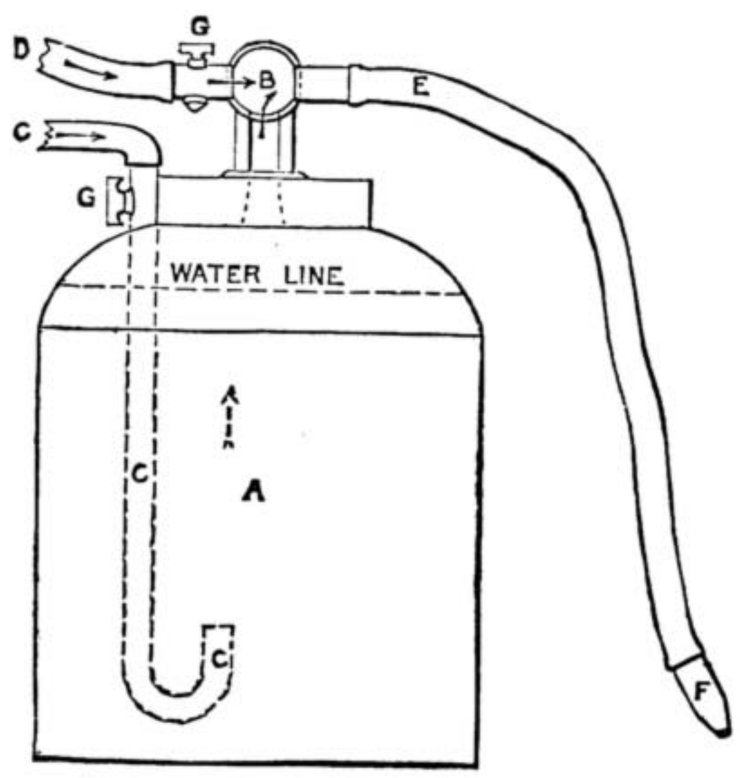
III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Polishing Oak Floors.—H. N. (*Bexley Heath*) asks, "How to polish oak floors that have been polished before. He has tried beeswax and turpentine, but that does not answer very well."

Fretwork Patterns.—W. E. M. sends two sheets from a fretwork pattern book, and is desirous to know who may be the publishers of the book, as he is anxious to get the book itself, regardless of expense. He is told that it is an American publication. If any reader can give the desired information will he kindly do so? The patterns sent to me are on sheets 14 in. × 11 in.; they are printed in black on white. Plate 2 (thus numbered) is a photo frame, with imitation door covering photo opening on hinges on one side. The door is fret sawn, and so is the gable-shaped finial with which the frame is surmounted. On each side of the top is a spray, the outline of which is shown on the frame in white dots. Fittings for supports of frame are also given. Plate 15 gives nine small patterns, embodying the adventures of a man and his donkey and donkey cart. The man comes to grief at first; but at last, by the advice of a passer-by, he puts the donkey into the cart—a proceeding which, apparently, causes trouble to both the bipeds. Perhaps this description of the particular plates may lead to the identification of the book itself.—ED.

Refrigerator.—URGENT writes:—"Being a reader of your excellent paper, and seeing you are willing to give advice to amateurs, I would take it as a favour if you would answer the following: *How to construct a refrigerator*, or ice chest, to keep meat, fish, etc., during hot weather. I have been asked to make one by a friend; the space I have is 7 ft. long, 3 ft. broad, and 3 ft. high, and also to use the top as a counter. There is also a descent for drainage, if wanted."—[This subject is thrown open to all constructors of refrigerators, and doubtless a paper on the subject from a practical man will soon be forthcoming.—ED.]

Oxyhydrogen Blowpipe.—T. W. B. (*Barnsley*) writes:—"I enclose a sketch of an oxyhydrogen blowpipe which I have devised, although I have never seen one. I enclose it for your inspection. Kindly answer me through 'Shop,' and say if you think it will be a 'workable' and 'safe' instrument. In the sketch, A is a tin chamber containing



water through which the hydrogen gas bubbles up from the pipe, C, into the chamber, B, where it mixes with the oxygen from the pipe, D, and passes immediately to the burner, F. G, G, are stop taps."—[I have given a half-size reproduction of your sketch, which was full-size, and I leave it to readers who are skilled in this matter to determine if your blowpipe be in every respect that which you hope it is.—ED.]

Wood Colouring.—"OX GALL" writes:—"I have made an overmantel in deal, and I want to know how to stain it a very dark colour in imitation of old black oak; also how could the dull polish seen on such wood be simulated with as little labour as might be consistant with a good effect."

French Polishing.—T. A. (*Belfast*) asks for "some information on the different methods of polishing wood, French polishing, wax polishing, etc. I French polish my fretwork as well as I can, having oiled the wood with linseed oil first, but invariably after a time the oil comes through the polish and spoils the work. I would like to know what preparation I should use to prevent its doing so."

Glaze for Finishing French Polishing.—W. H. B. (*Redditch*) writes:—"Could you tell me, through your valuable paper, WORK, a good receipt for making glaze for finishing off French polishing?"

Photo Colouring.—EXPECTANT (*Hull*) writes:—"I am an amateur artist (or, rather, try to be), and your articles on Crystoleum Painting and Sign Writing have interested me considerably. I should esteem it a favour if some one would kindly inform me whether photographs can be successfully coloured with water colours; and, if so, what is the best method, as I have often tried to colour them same as ordinary paper, but always failed."

Trade Notes and Memoranda.

SUGAR has been recently recommended by an Italian engineer as an anti-incrustation agent for steam boilers. In a boiler containing 126 tubes, the use of 2 kilos. (about 4·4 lbs.) of sugar per week had the effect of so far reducing incrustation, that at the end of four months only a very thin scale was formed, which was easily removed.

SOME of the remarks made by Mr. Sanders in his recent lecture on "Wood Carving" at the theatre of the Albert Hall are well worth perusal. He told his audience that carving should never detract from the use of the object, or weaken its construction. To construct decoration, instead of to decorate construction, is one of the greatest crimes an architect can commit. The use of glass paper is most mischievous, for it obliterates the mark of the tools, taking away all life and vigour, and leaving nothing but an inert mass of dulness behind. He said he looked forward to the day when the State would provide an institute for the carver, furnished with the best examples of ancient and modern woodwork, a reference library, and a staff of duly qualified masters, for construction, design, and carving, assisted by the advice of the great artists of the day.

AN enormous block of coal has been cut at the Abercarne Colliery as a specimen of the Welsh mining industry for the Paris Exhibition. It measures 7 ft. 6 in. high by 5 ft. 6 in. wide by 3 ft. 6 in. deep, and weighs 5 tons 10 cwt. It was hauled about a mile through the workings to the pit shaft. Five other blocks, each weighing 2 tons, will accompany it.

A PAPER read at a recent meeting of the International Society of Electricians in Paris contains the following items:—The total cost of the Exhibition to the French Government and town of Paris is estimated at about £2,000,000. There are, in round numbers, 50,000 exhibitors, each of whom will spend on an average £120, representing an additional outlay of £6,000,000. The number of hours during which the public will have access to the Exhibition is 2,520, making the cost of the Exhibition per hour about £3,000. The total electric lighting of the Exhibition is estimated to be equal to that of about 1¾ million candles.

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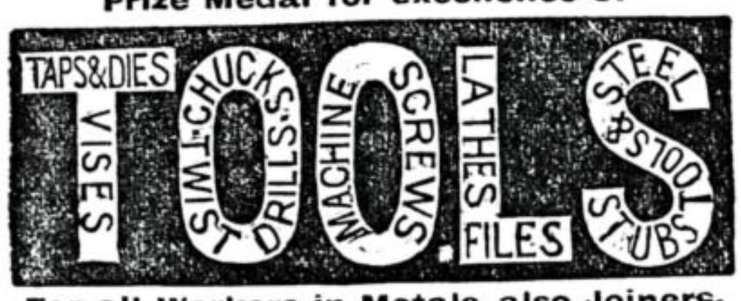

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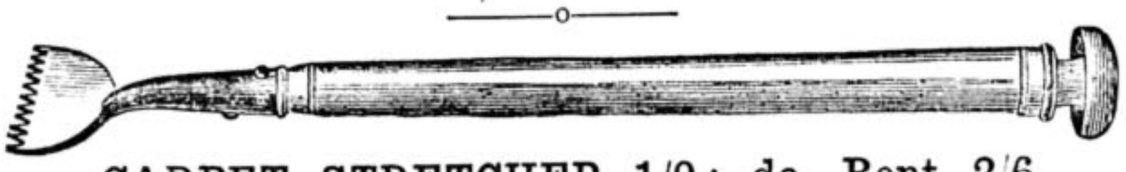

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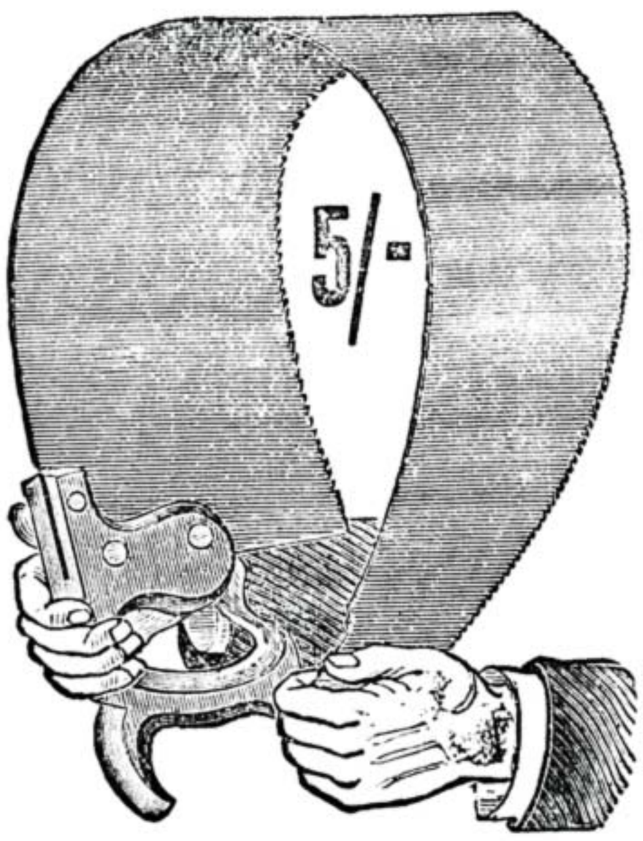

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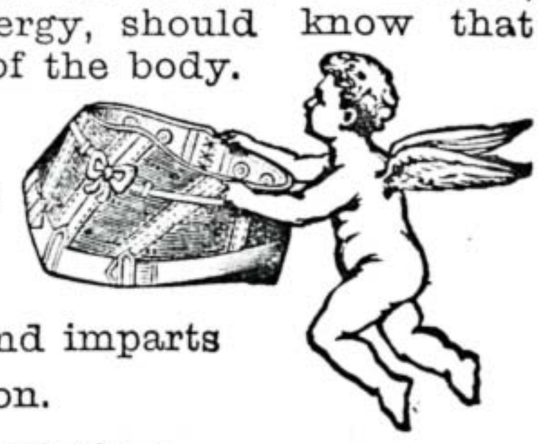

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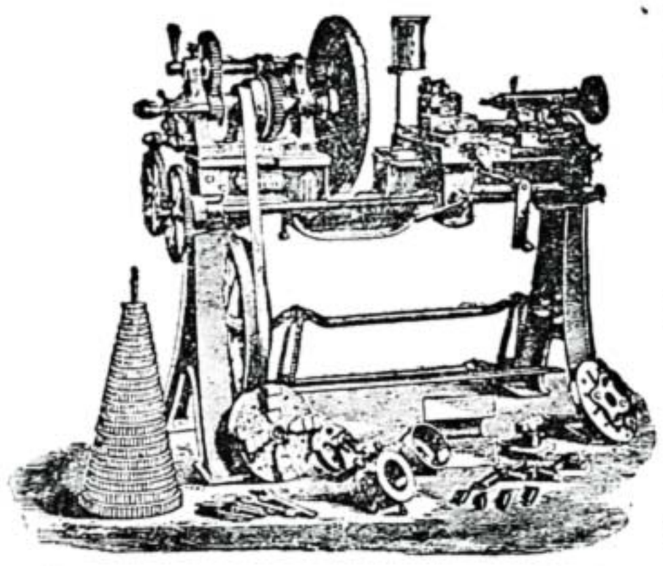

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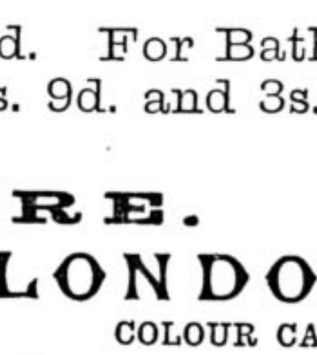

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